THE MODEL ENGINEER

IN THIS ISSUE

DECEMBER 23rd 1954
Vol. 111 No. 2796

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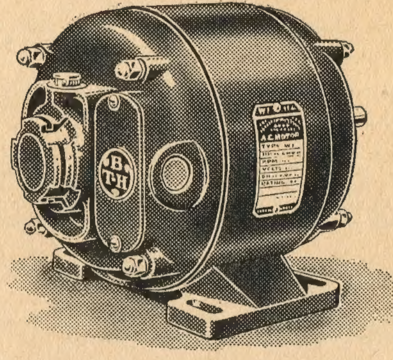

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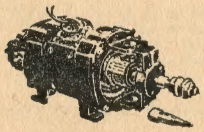

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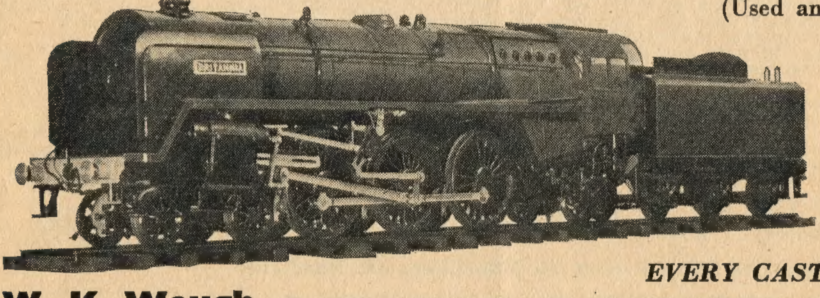

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THE MODEL ENGINEER

EVERY THURSDAY

Volume 111 - No. 2796

DECEMBER 23rd - 1954

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SMOKE RINGS

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OUR COVER PICTURE

It is seldom that both a model and a full-size locomotive can be seen in one photograph and especially when they are both actually working. However, this is the case in the picture on our cover this week. The small locomotive is a good performer, as proved by the fact that it operates Dick's Miniature Railway at Burntisland, near Kirkcaldy, and has hauled thousands of children during its career. The full-size train is the 5.13 p.m. Glasgow (Queen Street) to the North hauled by Class "B1," 4-6-0, No. 61064. There is a similar miniature railway alongside the main line at Arbroath, where the coast road is also close to the railway, but on the other side, and one wonders how many railway enthusiasts who use this road are aware of the existence of this delightful little railway just over the way.

Greetings

AS WE approach the fifty-seventh Christmas in the history of this, your magazine and ours, we extend our cordial good wishes to our readers, whoever they are and wherever they may be, for the season and for 1955. Nowhere more than among model engineers does the spirit of goodwill prevail, and we hope that these greetings of ours will add one more touch to that bond of friendship which we all value so much.

A New Word Wanted ?

IT IS, of course, inevitable that, as time goes on and new devices come into use, new words become necessary in our day-to-day vocabulary. Or are they ? This question is prompted by the prevailing fashion which seems to bring new words or terms into use just for the sake of making a change; e.g. a "house" is now a "habitation unit" to some people, for no apparent reason, and certainly not for any necessity.

But, on the other hand, some old words, when applied to new objects, tend to be ridiculous. As an example, we quote a note describing a visit to Portsmouth; the writer states: "I was actually on the lookout for the three relatively new Portsmouth-I.O.W. steamers *Brading*, *Southsea* and *Shanklin*. These motor vessels are quite unusual in that for a length of 195 ft. they have a beam of 46 ft. . . ." The point is: Can a "steamer" be a "motor vessel," or, conversely, can a "motor vessel" be a "steamer"? It may be quite possible to prove that each is either of which or neither of both, but we do not wish to precipitate an argument !

We believe that a "steamer" *is*, strictly speaking, a "motor vessel," and that ship lovers generally dislike the idea of a "motor vessel," i.e., a vessel driven by internal combustion engines, or compression-ignition engines, being called a "steamer." In this latter difficulty, a new word seems to be called for; we are not making any suggestions as to what it should be, though we hope that, if it ever comes into use, it will not only be exactly descriptive but will also meet the need.

Old Engine Saved

WE ARE very pleased to learn from Mr. N. W. Bertenshaw, Keeper of the City Museum and Art Gallery, Department of Science and Industry, Birmingham, that the South Eastern Gas Board have agreed to present their "Amos" engine, one of two referred to in THE MODEL ENGINEER of July 22nd last, to the museum. It is hoped to begin work on the installation of the old engine in its final resting-place early in 1955.

Her Fate in Doubt

THE FATE of B.R., London Midland Region, engine No. 50621, *ex* Lancashire & Yorkshire Railway 2-4-2 tank engine No. 1008, would appear to be in the balance. As recorded in July, 1953, the Lancashire & Yorkshire Railway Society have made strenuous efforts to secure the preservation of this engine. Her claims to distinction are: that she was the first locomotive to be constructed at Horwich Works, and was also the first of a very large number of 2-4-2 tank locomotives that have won world-wide distinction by reason of the enormous amount of good, hard work they have performed ever since the class originated in 1889.

These engines have worked every kind of railway traffic, ranging from the post-grouping "Manchester-Blackpool Corridor" express and pre-grouping "Fleetwood Boat Express" to local pick-up goods trains and station pilot duties. Whatever they did was done well enough to win them fame. Few people outside the two mid-northern counties of England can realise the honour and esteem in which the old Lancashire & Yorkshire Railway was held by everyone more closely associated with it, especially since the late 1880s when the late Sir John Aspinal, first as Locomotive Superintendent and later as General Manager, brought it right into the front rank of English railways.

Mr. R. B. O. Brindle, of the Lancashire & Yorkshire Railway Society, reports that No. 50621 was withdrawn in October, and demolition was actually started, but has ceased for the time being. It is much to be hoped that she may yet be saved for permament preservation.

A Useful Gas Blow-torch

By " Duplex "

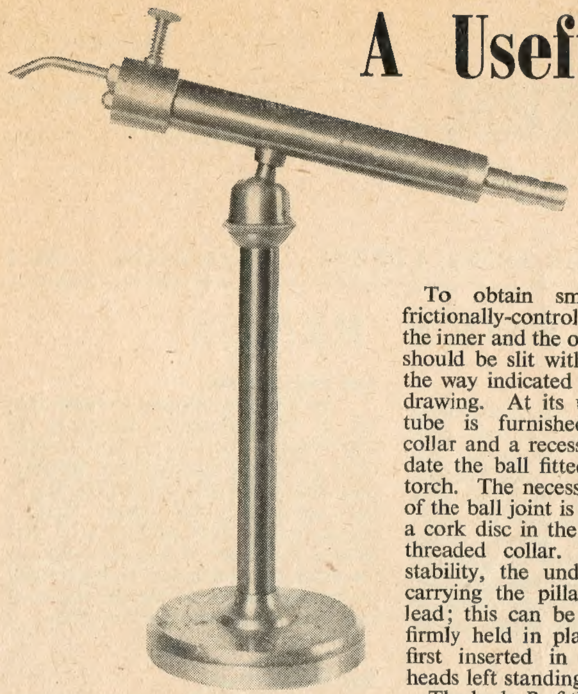


Fig. 1. The finished blow-torch

THE working principle of the self-blowing gas torch has, no doubt, been recognised for a very long time, although this seems to have been exploited commercially only in recent years.

In fact, we remember that more than forty years ago we inadvertently connected the laboratory blowpipe to the gas supply in a way that gave a flame akin to that produced with the air-blast working; moreover, this flame was adequate for ordinary glass working without the assistance of the foot-operated bellows.

The small gas torch illustrated in Fig. 1 emits an intensely hot, pale-blue flame, some 8 in. in length, when connected to the household gas supply, and it has been found capable of doing silver-soldering work of moderate size when Easyflo solder is used with the appropriate flux. For greater convenience of working the torch has been mounted on a stand that affords universal movement, and this has been found useful when the base of the stand is clamped to the arm of the brazing hearth, as an alternative to employing the large blowpipe with its air supply obtained from the mechanical blower.

Building the Torch

Although some workers may prefer a different form of mounting, the stand illustrated is quite easily made from two short lengths of the kind of brass tubing used for making telescopes and other optical apparatus; this material can be obtained from Messrs. H. Rollet, who advertise in this journal.

To obtain smooth working and frictionally-controlled adjustment, both the inner and the outer tubular members should be slit with a fine-tooth saw in the way indicated in the accompanying drawing. At its upper end, the inner tube is furnished with a threaded collar and a recessed cap to accommodate the ball fitted to the body of the torch. The necessary frictional control of the ball joint is provided by inserting a cork disc in the recess formed in the threaded collar. To afford greater stability, the under side of the base carrying the pillar can be filled with lead; this can be cast in, and will be firmly held in place if two screws are first inserted in the base and their heads left standing proud.

The body *B* of the torch is made from a length of thick-walled brass tubing, internally threaded at one end to receive the connector *H* for the gas supply. At the other end of the body, the head-fitting *D* is made a light press-fit and then sweated in place. A brass ball to engage in the cap fitted to the upper end of the pillar is screwed into the under side of the body, and a neater assembly is made by including the saddle-washer illustrated. A ball-fitting of this kind can easily be machined with the simple type of spherical-turning tool recently described in these columns. In this connection, a correspondent has kindly written to say that with this appliance he has successfully machined a batch of ball-headed fittings for attaching the drop-handles to a chest-of-drawers.

The head fitting *D* is drilled with two axial holes, and then tapped to receive the gas nozzle *F* and the gas nipple *G*.

In addition, the head is drilled and tapped for the regulating screw *E*. This screw is frictionally controlled by means of a small coil spring enclosing its shank.

The gas nozzle *F* was made from a straight length of $\frac{1}{8}$ in. diameter brass rod, drilled axially and then bent to shape. The nozzle, after it has been adjusted, is secured in place with a lock-nut.

The gas nipple *G* was turned from a piece of hexagon brass rod, and is drilled axially from behind with a No. 53 drill to within about 1/32 in. of the front face. If a No. 70 drill is not available for forming the outlet hole, a suitable drill can easily be made from an ordinary sewing needle. Break off the point of the needle so that a parallel

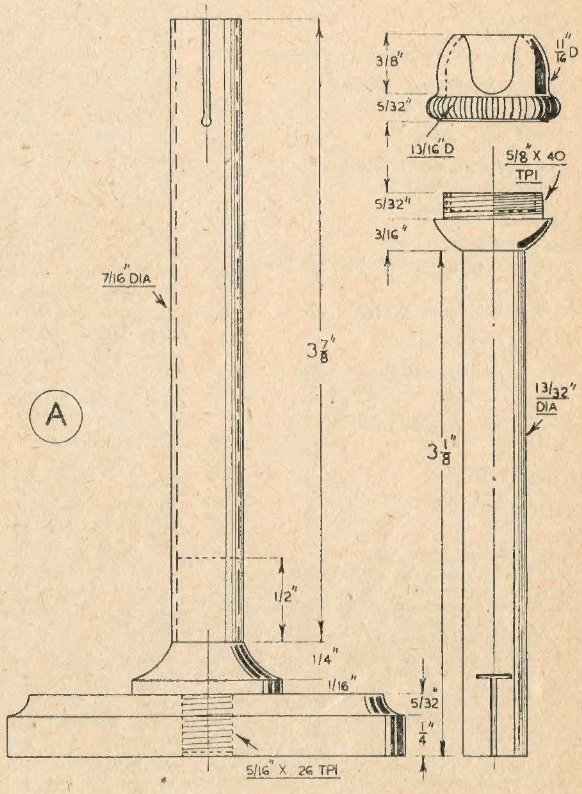


Fig. 2. The torch stand with universal head

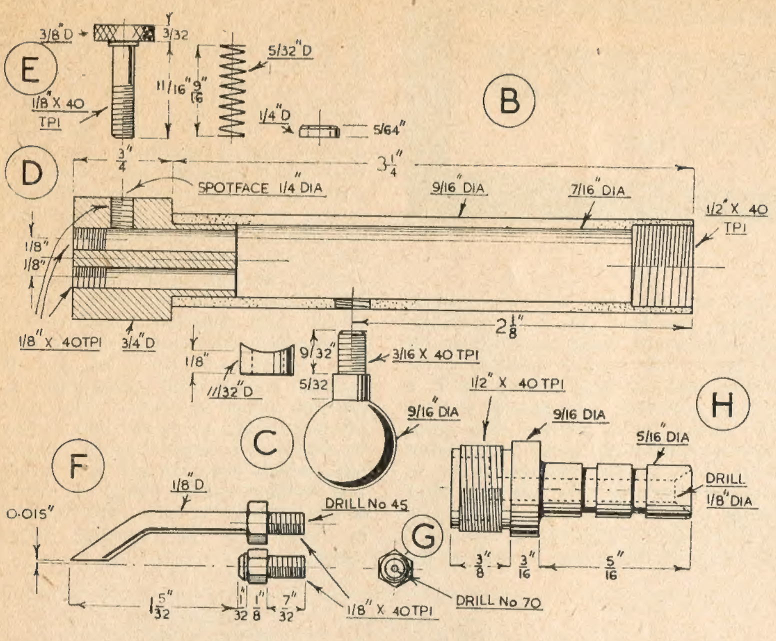


Fig. 3. B—the torch body; C—the ball mounting; D—the head fitting; E—the regulating screw and spring; F—the gas nozzle; G—the gas nipple; H—the gas input connector

portion remains, and then file or grind the tip to form a point with two cutting edges, like the ordinary spade drill. These needles are usually left soft enough to admit of being filed, and there is no need to harden the point afterwards for the brief drilling operation required.

The fitting *H* for connecting to the gas supply is a straightforward turning and drilling job, but the axial bore should be made amply large so as not to wire-draw the incoming gas.

Operating the Torch

After turning on the gas, a light is applied to the projecting gas nozzle and, unless the torch is used in a draught, there is but little tendency for the flame to light back and burn at the nipple; but should this happen, the flame can be restored to its proper place by blowing smartly on the nipple.

Although the torch gives a surprisingly long and hot flame when connected to the house gas supply, it is possible that in some districts the pressure may at times be abnormally low, and it will then be necessary to experiment with different sizes of nozzles and nipples in order to get the best results and obtain a uniformly blue flame. When the torch is in use, the base of the flame just touches the extreme tip of the nozzle, and there is no danger of the nozzle becoming heated or corroded; in fact, after some hours of use, the tip of the nozzle shows no more than a thin film of tarnish and the nipple is, of course, quite unaffected.

By turning down the regulating screw, an intensely hot, pointed flame is obtained, as short as only one inch in length; this type of flame will be found particularly useful where the heat has to be concentrated for small silver-soldering jobs.

If the torch has been properly made but does not give the results described, then it is probable that the gas pressure is below standard and the remedy lies elsewhere.

Making Miniature Wing-nuts

By H. H. Nicholls

THE writer lately wanted to make some wing-nuts, very much smaller than those in commercial production; in making models of chemical and other commercial equipment where they are used, the correct appearance would be entirely lost, if they were omitted.

I have sketched the method which was found suitable for making them without a great deal of trouble.

First, take a piece of small mild-steel (or brass) angle of the correct size, and cut off the parts shaded, and lettered *A*, *B* in Fig. 1.

File two steps on the end of the section left by this treatment; they represent the wings of the nut; drill and tap to the size wanted (the ones the author made were 8 B.A.).

Now mill a groove equal to twice the thickness just filed away, plus the allowance for sawing the blanks apart, *A* in Fig. 2, and also in the directions given by the sloping lines in Fig. 1, or put two hacksaw blades in one frame, and do the cutting with them.

Then by making the saw-cut *A* (Fig. 2), the blanks fall off from the stock, and will look like Fig. 3.

Now get busy with small files, and in a few minutes careful filing you have a perfect miniature wing-nut (Fig. 4).

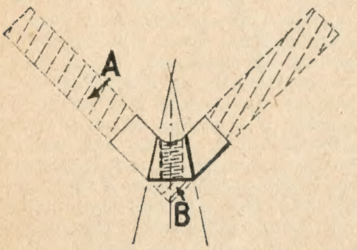


Fig. 1. Body of nut formed from root of angle

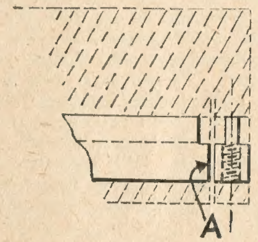


Fig. 2. Side elevation of nut blank being cut

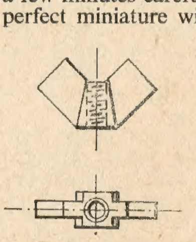


Fig. 3. Nut ready for finishing

Fig. 4. Nut finished

Such miniature nuts, down to 12 B.A., can easily be made by this method, which, in special circumstances, seems worth a trial. Of course, the tiny nuts can all be strung together on a wire, and plated or "dipped" by chemical means, to get the colour just right.

TWIN SISTERS

By J. I. Austen-Walton

At this stage, I am dealing with some of the most eagerly-awaited items, namely, the backhead fittings. There appears to be a large number of these, but don't be misled by the rather overpowering display they make when set out on paper. Every fitting and every *part* of each fitting is quite a simple job in itself, if regarded in that way; so forget about the general impression of complexity and take one thing at a time. First, a description of the dressing up of the backhead, and the purpose of the fittings. We have already had the water gauges, which, I forgot to mention, might be reduced to a single set in the case of "Minor." Even if the boiler had been made with two sets of pads, the unwanted pair could be plugged neatly, and left as a sort of reserve for future use.

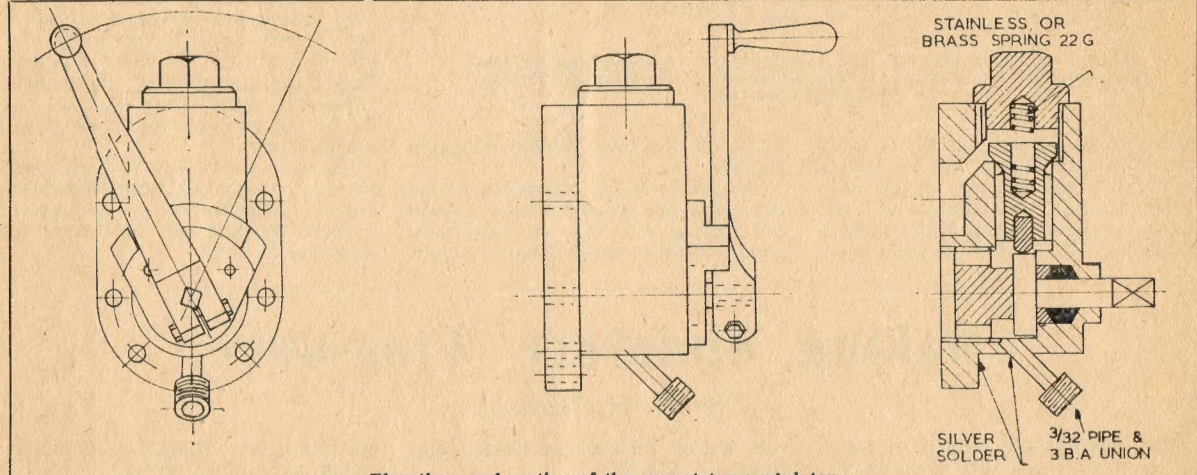
Next in importance comes the regulator. This is of the poppet type and has passed its tests with flying colours. I shall repeat my comments of an article or so back, to the effect that it is the most perfect steam control I have yet met, with a complete absence of backlash and a silkiness that makes it a delight to handle. I do not claim to be the originator of this type of regulator, but have merely adapted and condensed a more or less accepted type for the use of *Twin Sisters*.

Next, we have the two combined steam valve and water clack fittings, the left-hand one further combining the steam brake control, exactly as it is on the prototype, and almost as neat. The steam brake portion does come down to some pretty small and tiresome parts, but I have reduced it to its simplest elements. The left-hand clack fitting is for the use of the injector (if fitted) and the right-hand unit is for the track or axle pump, as well as the donkey feed pump, if this is desired. For both these feeds, the water delivery will be cold, and so we must not allow the water to go straight into the boiler *via* the backhead—the hottest part of the boiler. To get over this trouble, a long pipe is silver-soldered into the fitting shown, and the pipe is cut to a length that will reach almost to the front tube plate. It is true that, in the course of time and after long and continuous use, the pipe may become furred up both inside and out, but as the whole unit may be removed so easily and quickly, and "pickled" in the same way as injector cones are restored to a clean condition, there is little to worry about.

Continued from page 349, *September* 16, 1954.

A Combination Fitting

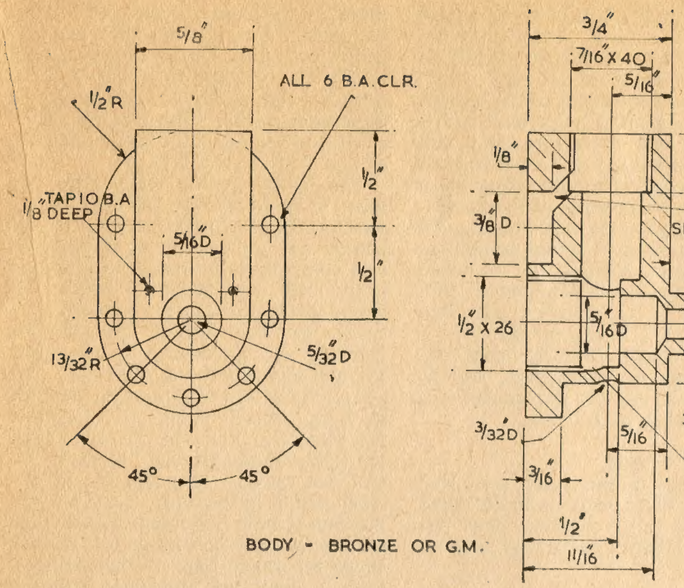
The whistle valve is really another type of combination fitting, for it provides connections for the outsize working whistle and the "dummy" whistle which, incidentally, is not altogether a dummy. It contains all the working parts correctly proportioned, and may certainly produce a supersonic note capable of being heard by a dog—not that it would perform a terribly useful function in so doing. Cats have certainly been known to prowl along miniature tracks, probably to lick the fishplates, and I remember encountering an exploring cat when I was haring round the old Burseldon circuit, years ago. I think that particular feline escaped with reduced expectations of life, and departed inland with an acceleration that caused audible claw-slip. Where were we? Oh, yes—the dummy whistle, and connections for pressure gauge as well. The entire fitting is made on to the boiler crown by means of a single "banjo" type of bolt, which does the job very neatly. The dummy whistle, being so closely connected with its valve, will be shown in detail. It is certainly worth making.



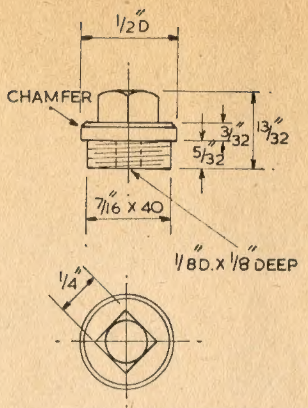
Elevations and section of the poppet-type regulator

Now for some descriptions. The regulator is the first item. You may remember you were advised to make up matching plates when you tackled the pads on the backhead, and in which case you will have the foundation of the fitting now to be made. The body of the regulator is a simple block of metal machined up as shown, and nothing could be more straightforward externally. The inside portion needs a little more care and thought, and after silver-soldering the block to the backplate, it should be set up in the four-jaw chuck and the back contact face skimmed to produce absolute flatness, and then positioned so that the blind entry socket can be bored, prior to the cutting of the flat port that runs up to break through, just above the poppet valve seating.

The second boring operation is that in the lower portion, consisting of a



BODY - BRONZE OR G.M.



MAIN CAP - BRASS OR G.M.

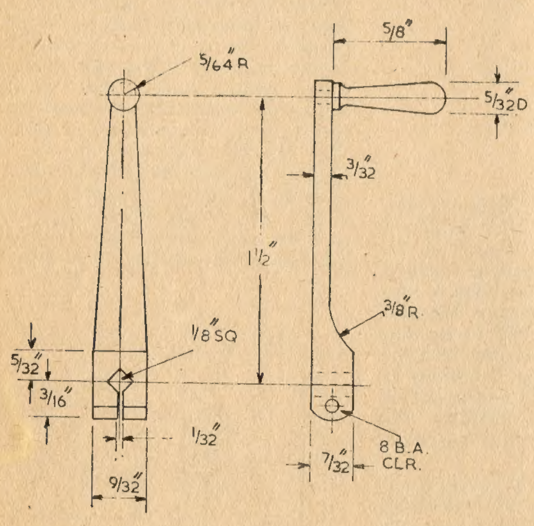
5/32-in. hole drilled right through and opened out to $\frac{5}{16}$ in. to produce the packing gland cavity. The actual boring comes next, carried in to a flat face on which the cam spindle will bear, for which reason, the smoother and flatter it is, the less work the gland will have to do. Given a really good and flat face to each part, the gland might be dispensed with altogether, but I have retained it in order to provide a little friction, without which the regulator is so free working that it might well shut itself off if not held in position; this actually happened with me, and I had to pack the gland a bit tighter. The packing of the gland, you will notice, is from the *inside*, and the cam spindle itself squashes the packing washer down and compresses the yarn filling. An external packing gland would have looked extremely clumsy, and the total projection of the fitting extended considerably. After boring, the $\frac{1}{2}$ in. × 26 thread is cut for a length sufficient to give adjustment to the retaining plug. I do hope this will be *screw cut*, and not hacked out with a blunt tap.

The next operation is also a four-jaw job, and this time the poppet-valve bore is tackled. Every part of this should be bored and *not* drilled. For one thing, a drill seldom produces a good round hole, even if it looks like it, and the skirt of the poppet valve has to slide freely in the main bore, which must also be perfectly true with its seating. This seating, by the way, is formed in just the same way as for a normal clack valve, so take care with] the sharp edge. The threading for the top cap may be tapped if you so wish, for the plug is not governing any other alignment except the spring, and this is not important for a matter of a few thou.

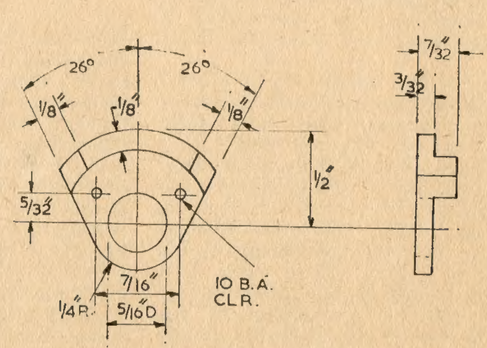
The poppet valve itself is perhaps the part requiring the most care in its making. I suggest the following method :—Chuck a piece of stainless-steel, and turn it down to the valve head diameter, and then to the diameter over the " spiders." You can check this by offering up the bored body of the unit, and the fit should be close but free sliding. Set over the top slide and turn the seating portion, cutting in until the full core diameter is reached, or even a little below it. Centre and drill the end hole to take the bronze cam peg.

Formation of Spiders

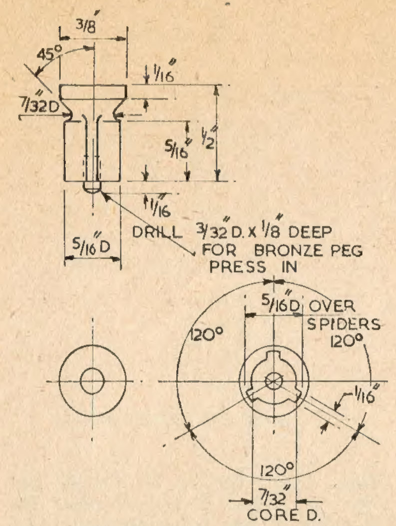
Now we come to the formation of the spiders themselves, and to do this we set a cutting tool on its *side* and prepare to use the lathe as a shaping machine. By taking only light cuts and traversing the saddle by the rack handle, the job should take a little under half an hour. For divisions, set up a simple pointer near the chuck jaws, using these for settings to leave the spider thickness. For example, start cutting when the



REGULATOR HANDLE - STAINLESS ST OR M.S.



HANDLE QUADRANT - STAINLESS ST OR G.M.



POPPET VALVE - STAINLESS STEEL

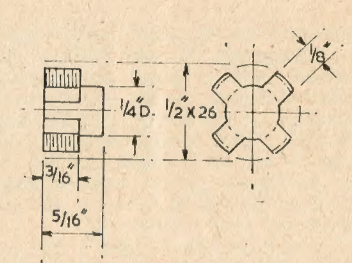
pointer is a quarter of an inch from the top edge of one jaw, and continue round until the pointer is a quarter of an inch from the opposite face of the next jaw. Now stop cutting until you have moved the chuck round to a position corresponding to the one at which you started, but on the next jaw to it, and so on—three times. I often do quite elaborate shaping or slotting jobs in this way, and the results are very satisfactory indeed. For a slow feed, I take the belt off, engage back gear and feed on the pulley by hand, moving it a mere fraction to every sweep along and back with the tool. It is also a distinct advantage to have a stop on the lathe bed itself, to prevent the tool overshooting the mark, and running into the valve face. Having turned the valve down to core diameter or a little less, the tool will have an easy run out at the end of its travel, and there will be no serious burrs to remove.

When all this has been done, you may part off the finished valve, after which it can be chucked carefully in a split tube, or even held by its core diameter which will suit the three-jaw chuck admirably. The remaining job is just a hole in the head to take the spring, and that's that.

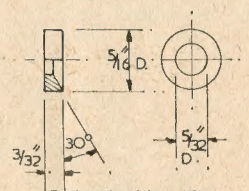
Only the cam spindle and the cutting of the steam port really deserve further mention ; the other parts are as simple as they can be. The cam spindle, as a turning job, is straightforward enough. The cutting of the cam profile is a job that should be left until all the remaining parts are made. For your eventual guidance, however, this amounts to the cutting of a slot, 3/32 in. deep, at a position relative to the square on the shank ; this, if you glance at the drawing is at 26 deg., from the corner-to-corner position of the square, but you may well prefer to do the shank squaring by sight, later on. The cam profile is not easily shown on the drawing, but is, in fact, a very gradual lift for about a third to a half of its travel. From there on, the lift may be accentuated rapidly to give a full opening of the valve within the remaining movement of the handle. All this cam profiling is best done with a smooth file, and, preferably, tried with the poppet valve in place, so that you can observe the degree of lift taking place with varying movements of the handle. It is a great advantage to be able to get a slow and progressive steam admission, especially when starting up, or when anxious to avoid excessive wheel slip. The surface of the finished cam face need not be too highly polished, for it is desirable to have a little frictional drag to avoid over-easy operation, and to resist the tendency for the regulator to close itself when on the run.

Steam Port Cutting

The cutting of the steam port that connects the blind pocket with the upper part of the valve chamber does not entail any elaborate setting-up, or even



RETAINING PLUG - G.M.



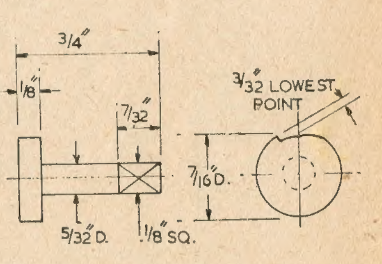
PACKING WASHER
BRASS

high-speed milling. The component has been designed so that, after drilling a starting hole to break through in the right place, a tension file may be threaded through, and the port extended in the required directions. I suggest that you work from the top, in order to see that the port cutting does not run into the poppet-valve face. There is nothing to damage on the other side, so you should be able to file away in comfort. The whole job takes about fifteen minutes at the outside.

The quadrant, in case the obvious way of making this part has not immediately occured to you, is produced as a continuously turned part, in the form of a dish. This would be a disc, 1 in. in diameter and 7/32 in. thick, with the middle turned away to leave an internal diameter of $\frac{3}{4}$ in., and the $\frac{5}{16}$ in. dia. hole drilled or bored. The necessary segment is then cut out, and the " gap " in the quadrant rim, milled or filled out to the dimensions given. The quadrant itself is fixed to the regulator body by means of two 10-B.A. set-bolts.

The retaining plug really does two jobs : it keeps the cam spindle firmly in place, and may also be used to vary the handle working tension or friction. It also compresses the gland packing and keeps that department in order. It would be a good plan to make up a simple two-peg key or spanner for inserting and tightening the plug, and the tool kept for future servicing. The plug is really made on the same principle as a gun breach-block, an association just remotely connected when you open the regulator and give her " the gun." If you can manage to make the plug a fairly stiff fit in the body, it will prevent the cam spindle loosening or tightening the mechanism—a point to be watched. From the lower part of the regulator body, a small pipe and union emerges. This is to feed the lubricator tank, and is so positioned that steam will be admitted only when the regulator is open. The pipe may be made to break through anywhere in the lower chamber, but should be far enough forward to enable the nut to be put on the stud that comes immediately under it.

And now for the remaining points. The poppet valve should be seated in a similar way to the method used when seating a ball-valve. Make sure the valve seating is clean and free from rings or ridges—I refer to the valve itself, of course. A tap with a soft punch and a light hammer should bed the two parts together, and the resulting fit can be tested by blowing down the top cavity whilst holding a finger over the blind cavity at the back of the fitting. The cam spindle should be inserted and steps taken to make sure that, in the closed position, the cam is not actually in contact with the lifting peg under the valve, which would cause incipient leakage and, eventually, wire-drawing. A spring should be wound up as specified. This can be quite stiff, for the cam action is so powerful that you will most probably be unable to detect its presence in any case. Under 100 lb. steam pressure, the valve action is almost absurdly light, and one experiences no jerkiness



CAM SPINDLE - STAINLESS STEEL

when breaking the first steam seal—a phenomenon that appears to be more theoretical than actual.

The final adornments are purely routine work, yet they are worthy of care and good finish being put into them. The square in the regulator handle should be filed out with great care, so that there is no suggestion of rocking or unwanted movement. If the square really fits its shank, the 8-B.A. bolt will more than look after its security.

One is Apt to Forget

With the writing of these articles, I am often guilty of describing machining operations as incidents involving little more than a few minutes of one's spare time. I have always been a champion of the principle of making the method suit the work being tackled, and modern developments in the design of machine tools and their attendant accessories have contributed in no small measure. The new Burnerd Tool Post is one of these scientific developments, and I can quite safely say that to be without it would be quite unthinkable. The ability to change tools of an infinitely wide range of uses and operations is in itself a dream of delight, and the general saving in time—the invaluable commodity that seems still to be rationed strictly—cannot be assessed. Quite recently, I did a little job for a Swiss instrument firm, who were good enough to advise me that the official time required to do the job, worked out on a time-study basis, was 85 hours. I thought no more about it until I worked out my own time, and was amazed to note a total of no more than 45 hours! Since then, I have found similar savings to be the normal thing. I don't know why we lag so far behind in this country. In most of the European countries the versatile, quick-changing type of tool post is fast coming into use. Just how we have managed to put up with all those wasted hours of fiddling about with bits of broken hacksaw blades and pieces of brass shim stock just beats me.

If, in future, you read more about *bored* holes instead of *drilled* holes, you will know that a delay of not more than two seconds in changing from a turning to a boring tool has a lot to do with it; apart from which, the degree of eccentricity in a drilled hole is a little alarming when you compare both methods carefully. I had occasion, just lately, to drill a series of very small holes in dural. The holes were over $\frac{3}{4}$ in. long, and about 9/64 in. in diameter. I drilled one hole first, noting with satisfaction how truly the drill followed the initial centre, and would normally have passed it as 100 per cent. As a matter of interest and research, I set up my baby boring tool, now permanently held in one of the Burnerd recessing holders, and took a very light cut. The "true" drilled hole showed up as distinctly eccentric as the tell-tale marks of the boring bar left its cutting tracks on one side only. The back end of the hole was much more out of truth, and I had to take several cuts before there was witness all round. That settled it!—bored holes in future, especially where truth was going to be essential, and no more than two seconds in setting up for the job!

And now, finally, the setting up of the regulator is a matter of packing the gland with graphited yarn, taking care not to overdo it, and making a jointing packing for the back face. The spring may, to advantage, be made to fit a little tightly in the poppet valve itself, although not in the top cap, of course. Cleaning or servicing of the unit is then made easier in that the valve may be lifted out by removing the top cap only. Turning the engine over and shaking it violently is a pastime I do not recommend!

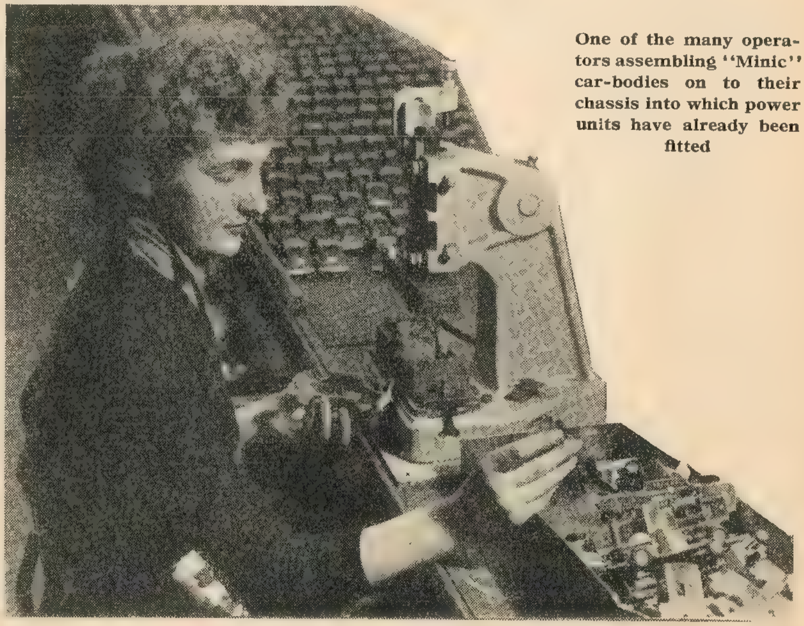
(To be continued)

THE WORLD'S LARGEST TOY FACTORY

On a recent visit to the factory of the Lines Bros. group of companies, at Merton, London, S.W.19, an inspection of the wide range of products, and the ingenuity of their design and production methods, confirmed the impression that in this department of industry, as in many others, British manufacturers have achieved world-wide distinction, and are still forging rapidly ahead. The factory covers an area of 700,000 sq. ft., including over three miles of roadways between buildings, and its output accounts for nearly one-third of total exports of toys from this country.

Over 1,500 varieties of toys are produced at Merton, including "Tri-ang" mechanical toys, model railways, tricycles and juvenile cycles, "Minic" scale model road vehicles, "Penguin" model boats, "Pedigree" dolls, soft toys, and baby carriages, and "Frog" model aircraft engines and electric motors. From the very simplest toys upwards, design and production are as carefully planned as for the most elaborate industrial products, and equipment is on the most up-to-date lines. A large section of the factory is devoted to die-casting, and another to surface treatment, plating, and polishing of metals; tube bending, welding, enamelling, rubber processing, and presswork are dealt with in their respective departments.

The showrooms alone cover an area of 5,500 sq. ft., and are equipped for the effective display and demonstration of the toys; they are visited by a constant stream of home and overseas buyers. Although there are many types of toys which may be regarded as traditional, and for which there is always a steady demand, styles and varieties are constantly changing, and the increasing sophistication of the modern juvenile puts new emphasis on quality and accuracy of detail. It is to the credit of British manufacturers that they have not only kept development fully up-to-date, but have in many cases even anticipated demands. A design and experimental department, with a staff of about 100 skilled men and women is maintained at Merton, and is responsible for the development and testing of all products.

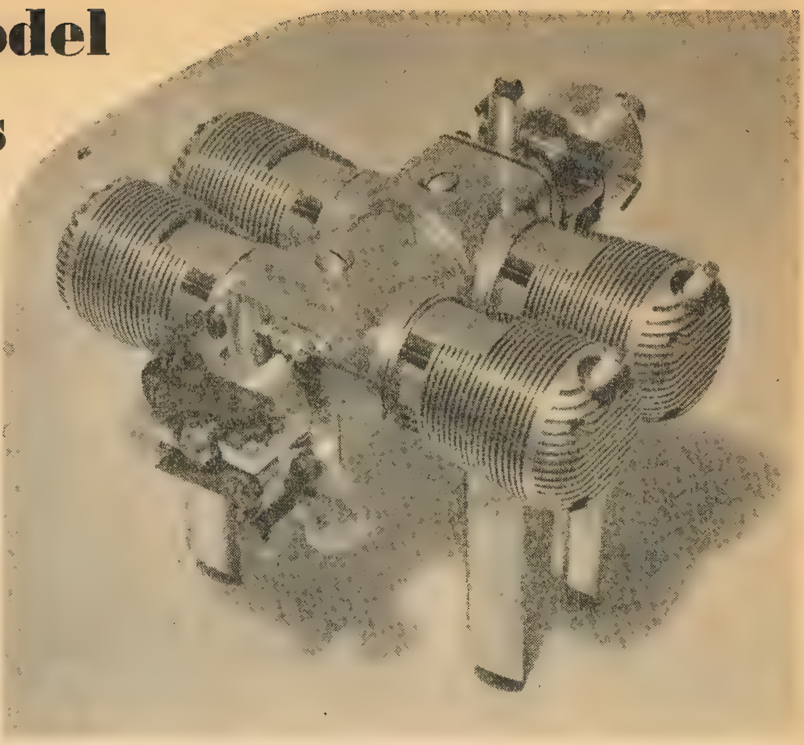


One of the many operators assembling "Minic" car-bodies on to their chassis into which power units have already been fitted

Notable Model I.C. Engines

THE AMCO MARTIN FLAT-FOUR

By P. G. F. Chinn



In this rear view can be seen the two screw plugs in the top of the crankcase where the nozzles of the fuel injection system were fitted. Note also the dual contact breaker, a duplicate of which is fitted at the front to provide two-speed operation

EARLY in 1948, the Anchor Motor Company Ltd., well established automobile, commercial and agricultural engineers, of The Newgate, Chester, entered the model engine market with a 0.87 c.c. model aircraft engine of the simple three-port compression-ignition type, known as the " Amco " Mk. I.

The following year, in addition to an improved Mk. II version of this motor, this firm introduced a radically new 3.5 c.c. shaft rotary-valve unit of exceptionally high power-to-weight ratio which, despite a rather common tendency to break connecting-rods, crankshafts and gudgeon-pins, achieved considerable recognition in the competition field.

Later, a glowplug ignition version of of the 3.5 followed and, early in 1951, an entirely revised design of somewhat more robust construction, having a rotary-disc type induction valve (the disc, incidentally, being of " Tufnol ") and twin ball-bearings for the crankshaft, was introduced.

The designer of these engines was Mr. E. C. Martin and, following his leaving the company at the end of 1951 to go to Canada, Anchor Motors closed their model engineering division, disposing of the manufacturing rights of the Amco engines to a London concern. Prior to this time, Anchor Motors had had considerable difficulty in keeping abreast of the demand for their model engines, due to the fact that much of their machining capacity was now occupied with Ministry of Supply contracts, but before these difficulties arose, Mr. Martin designed and built a 40 c.c. horizontally opposed four-cylinder engine as a basis for the design and development of a power unit for radio-controlled target aircraft. This prototype came into the writer's hands for testing and, although, unlike other engines with which we have been dealing in these articles, it did not reach the production stage, it is, we feel, of sufficient interest to warrant inclusion in this series.

Something of an " in between " as regards capacity, the engine was, of course, rather bigger than the capacities most favoured by model engineers and enthusiasts requiring power units for model propulsion. All the same, although, for example, small " clip-on " bicycle units of less than 40 c.c. capacity have been seen, the application envisaged obviously required, in the case of the Martin engine, a higher power-to-weight ratio than was to be found with these small single-cylinder " full-size " engines.

Thus the Martin flat-four began life purely as an experiment, the designer being prepared to have to revise his ideas of shaft and bearing sizes, etc., and also his hopes as to the serviceability of a unit based, in the interests of performance, on model, rather than full size, design practice.

The engine was of the two-stroke cycle, spark ignition type, and, although it was later fitted with conventional needle-valve carburettors as shown in the photographs, was originally designed to accommodate a fuel injection system. This consisted of two injectors fitted in the separate front and rear crankcase compression chambers and a small metering pump. Air induction was controlled by separate rotary-valves to the respective crankcase halves.

No throttles were fitted to the engine. Instead, a simple two-speed ignition timing arrangement was adopted. This obviated any need of electric motors and gear trains to operate throttle linkages and, because of the two-stroke engine's ready response to speed adjustment by ignition advance and retard, this was, in fact, one of the reasons for choosing the two-stroke cycle type.

Ignition was by means of two twin-spark coils, no distributor being used. Thus, two sets of contact-breaker points were required, operated by a single lobe cam attached to the crankshaft. The points, which were of the conventional car type, were mounted on a machined aluminium clamp, adjustable for advance and retard, and a duplicate assembly, carrying two more sets of points, was mounted at the opposite end of the crankshaft to provide the secondary speed control. By setting one of the double contact-breakers to provide an advanced ignition point while the other set was adjusted to a retarded position, effective two-speed control was obtained simply by switching from one circuit to the other, using, of course, the same two ignition coils.

Since both front and back sets of contact-breakers were fully and independently adjustable, any combination of speeds could be obtained.

As will be gathered from the fact that separate front and rear crankcase chambers were used, while two pairs of simultaneous sparks per revolution were provided, the Martin flat four was, in effect, two simultaneous-firing, horizontally-opposed twins arranged in tandem, the front and rear pairs firing alter-

nately. Champion VR.2 ¼ in. miniature sparking-plugs were fitted.

The construction of the engine was mainly of light alloy, contributing to its exceedingly moderate weight of only 3 lb. The well-shaped finned cylinder barrels were machined in one piece with the deeply finned cylinder-heads and, with liners inserted, were each held down by four long bolts passing through from the cylinder-head. The four-throw crankshaft was in two sections and, of course, the connecting-rods had split big-ends. The pistons were of aluminium with two compression rings and straight baffles.

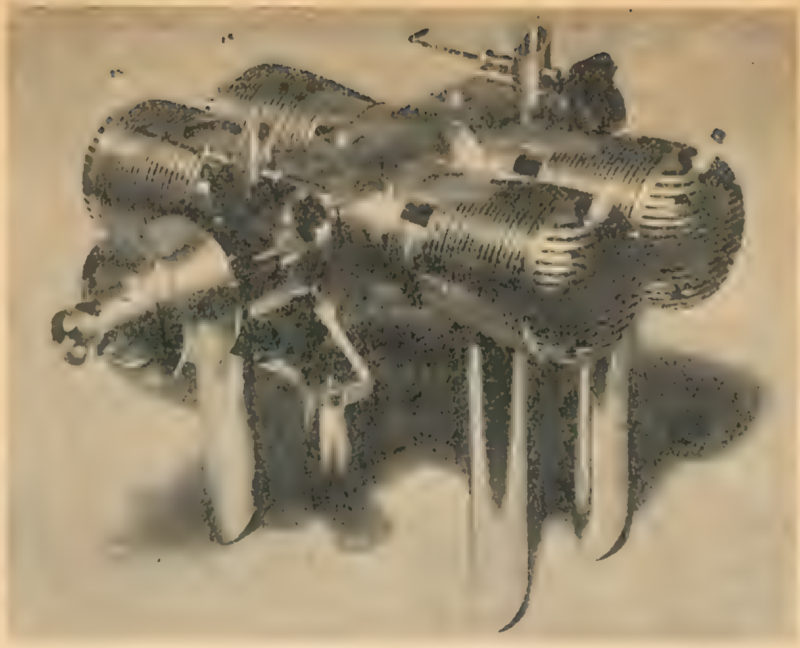
The cast light alloy crankcase was of the barrel type with detachable end covers also incorporating main bearing housings. Lugs, or feet, were also attached to the engine at these points for mounting purposes.

As originally built for target aircraft, the engine was not over-ported and was provided with exhaust pipes as shown. These were screwed, by means of a gland nut, on to the cylinders.

Later, the prototype engine was modified experimentally to determine the possible power output with development. The intakes were connected to a single carburettor and breathing was then improved by the simple expedient of adding four sub-piston supplementary air ports to each cylinder. In view of the higher volumetric efficiency thus encouraged, the compression ratio was lowered slightly and the crankcase was used (*via* the disused injector holes) to pressurise the fuel supply *via* a sealed fuel tank and thus maintain a constant pressure at the carburettor jet.

By these means the output was increased appreciably and the designer considered that an output of 5½ b.h.p. —i.e., approximately 140 b.h.p./litre—was possible. Equally impressive is the power/weight ratio of nearly 2 b.h.p./lb. that this represents.

The engine was designed to operate on an alcohol fuel or, with the use of soft aluminium decompression gaskets, on a petrol mixture. Lubrication was, of course, by the common "petroil" mixture method.



The Amco Martin Flat-Four was intended to form the basis of development for a radio-controlled target aircraft engine

In effect, this four-cylinder two-stroke was two simultaneous-firing twins arranged in tandem formation. With development, it was considered that specific output would reach 140 b.h.p./litre

Next Week . . .

A BORING HEAD FOR THE LATHE
"Duplex" describes the construction of a lathe attachment for boring and facing, incorporating automatic cross traversing feed.

THE "VULCAN" BEAM ENGINE
More about the machining of components for the valve gear and motion work.

MILLING CUTTERS
How to make simple built-up cutters, with separate inserted teeth, which will work as efficiently as expensive solid cutters.

A PICTURESQUE TRACK
The Cumberland Guild of Model Engineers' new track at Workington is described and illustrated.

LOBBY CHAT
A further batch of miscellaneous notes from "L.B.S.C." including photographs of locomotives made by some of his followers in different places.

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:
(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

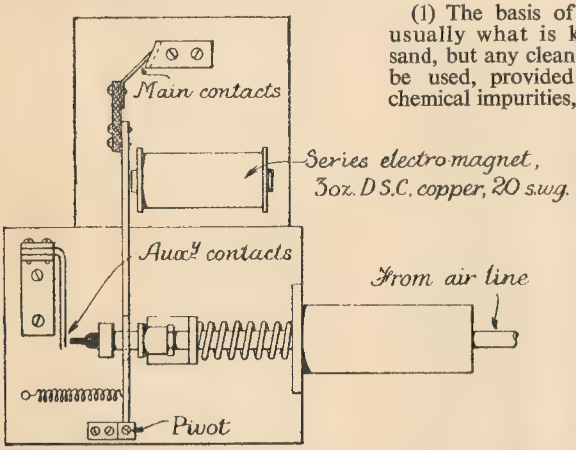
Pressure-operated Switch

Can you please illustrate and describe the principle and operation of a pressure switch as used in an air compressor plant? The particular point which I cannot understand is how the switch cuts out at a high pressure, and cuts in again at a lower pressure.

P.A.L. (Redcar).

The drawing shows the arrangement of a switch of this type. The switch is operated by means of a small cylinder having a spring-loaded pressure-tight piston, or, alternatively, a diaphragm could be used.

The loading of the spring is arranged so that no movement of the piston takes place until a predetermined pressure is reached, and the end of the piston-rod is fitted with shouldered collars which pass through a slotted hole in the switch lever. At the extremity, an insulated contact-finger is fitted to the rod, so arranged that at a set pressure the rod closes the contacts of a relay switch.



Under normal circumstances, the main contacts of the motor circuit are held closed by means of an electro-magnet in series with the motor windings. The relay switch, however, short-circuits this magnet and the switch is then quickly broken.

When the pressure in the air cylinder falls by a predetermined amount, the relay contacts are first opened, but the main switch is not operated until the pressure has dropped further, when the switch lever is then pulled into contact and held by the magnet.

This particular arrangement gives positive operation and avoids chattering. It is capable of controlling a motor taking a fairly considerable amount of current.

Sand for Moulding

I have just made a small furnace capable of melting iron, but I should be glad of some advice regarding the sand used for making moulds.

(1) *What is the composition of this sand?*

(2) *What are cores made of?*

(3) *Could the same sand be used for moulds for brass casting?*

(4) *Is it possible to use plaster of paris instead of sand for moulds?*

A.E.H. (Huddersfield).

(1) The basis of moulding sands is usually what is known as "green" sand, but any clean fine-grade sand can be used, provided that it is free of chemical impurities, such as salt, which is usually found in sand obtained at the seaside. Specially selected and prepared sand is obtainable from dealers in foundry supplies.

Various substances are often added to sand to make it more suitable for moulding, including brick dust, dry clay powder, etc. The sand must be just sufficiently damp to cohere firmly, but excess moisture must be avoided.

(2) Cores are made from the same sand, in some cases with additions of oil or gum to make it more adhesive.

(3) The same sand can be used for brass moulding.

(4) Plaster of paris is not suitable for ordinary moulds, owing to difficulty of providing sufficient air venting to release the gases in the molten metal, but plaster moulds are used under certain circumstances, for casting by the method known as the "Lost Wax Process."

The new P.M. hand book *Foundrywork for the Amateur*, which will be on sale early in January, gives full particulars of moulding materials and methods.

Steel for Wringer Shafts

I wish to replace the shafts of an electric washing machine wringer, as they are liable to rust and cause severe wear on the hardwood bearings. Would you recommend replacing these by stainless-steel? I ask this because I am doubtful as to whether this material would be equal in strength to that originally used.

A.S. (Kirkcaldy).

The standard grades of stainless-steel would be quite suitable for journals for this type of machine. An alternative method would be to thoroughly clean the existing journals and get them plated with a hard chromium deposit, which would resist both wear and corrosion. This type of electro-deposition is done by several firms including:

Fescol Limited, 41, North Road, London, N.7.

Durachrome Limited, 171, Ilderton Road, London, S.E.16.

Small Driving Chain

I am making a small petrol engine and require about 12-in. of chain for the camshaft drive. Please advise me what suitable chain and sprockets are available, and where they can be obtained.

J.N.C. (Bishops Stortford).

We presume that you require roller chain of the same general design as that used for cycle and motor drive.

The smallest standard roller chain that we know of is the 8 mm. chain manufactured by Messrs. Hans Renold & Coventry Chain Co. Ltd., 28, Deansgate, Manchester, 3, and sprockets to fit this chain are also available.

We understand that some of our "M.E." advertisers are able to supply this, including Messrs. Bonds o' Euston Road, 357, Euston Road, London, N.W.1.

Worm Reduction Gears

I am making a domestic washing machine, and wish to obtain a worm reduction gear box to reduce the speed of the motor, which runs at 1,425 r.p.m., down to approximately 50 r.p.m., which will call for a ratio of 28 to 1, though 30 to 1 would probably be near enough. I have approached one of your advertisers, who list a gear box of this type, but they inform me that this is not suitable for continuous duty at this power.

I.L.T. (Abertillery).

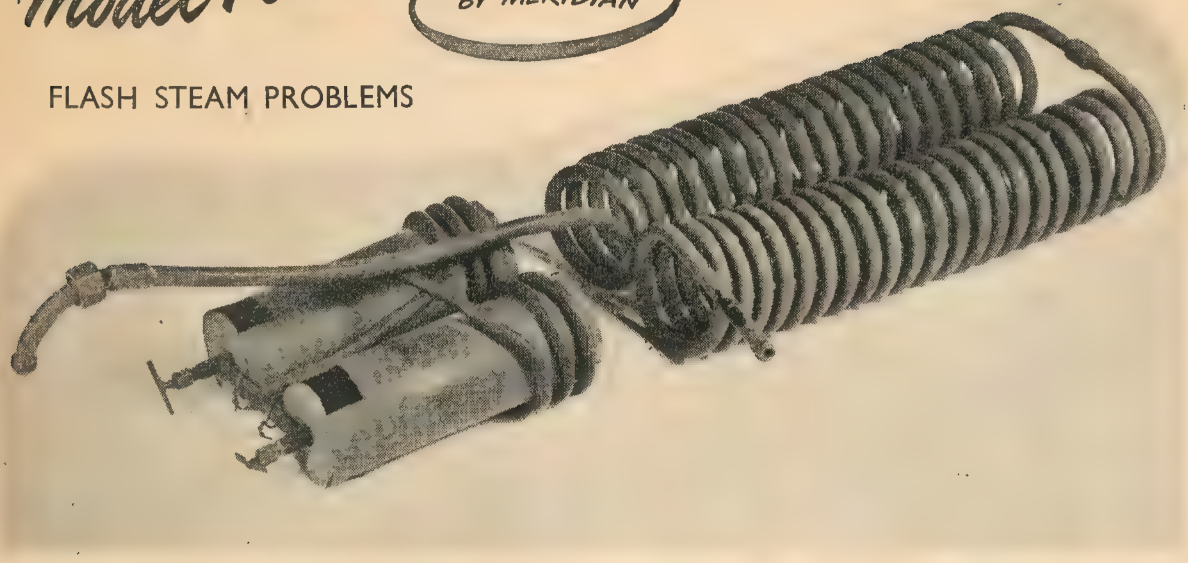
We cannot say definitely what power capacity can be expected from the worm gear units available on the market, but we suggest that the reduction gears manufactured by Messrs. S. H. Muffett Ltd., Mount Ephraim Works, Tunbridge Wells, or C. C. Whitney & Co. Ltd., 1, Fairlop Road, Leytonstone, London, E.11, might perhaps be suitable.

These are made in a range of sizes and reduction ratios, which should cover your requirements.

Model Power Boat News

BY MERIDIAN

FLASH STEAM PROBLEMS



A typical double-coil flash boiler and twin blowlamp burner: (Boiler: 20 ft. of 19 S.W.G. steel tubing, ½ in. dia.)

"SPEED boats are designed according to the fancies of the owner. Their appearance is controlled by such factors as stability, wind resistance, and the amount of cheese eaten for supper by the designer. It is the aspiration of this eternal optimist that the speed will be so great that the boat will appear only indistinctly to the onlooker.

"Most racing boats are propelled by petrol engines, although a few enthusiasts who are on the highest plane of optimism use 'flash steam.'

"Petrol boats are started by a sort of diabolo motion which develops bulging forearm muscles, and it is untrue to suggest that this is the winding up of a powerful concealed spring motor. Quite frequently these boats develop their best speeds late in the run, or even in the most annoying cases after the completion of the measured distance. This is due to the phenomenon of carburation, assisted by centrifugal force.

"Flash steam boats evaporate pond water in a coil of tubing heated by a powerful blowlamp, and are much more likely to start with a rush and slow down after a few laps. Even the fires of the nether regions would be insufficient to heat the boiler of a flash steamer for any appreciable length of time."

This humorous dissertation, taken from last season's regatta programme of the Southampton club, was intended to enlighten the non-technical spectator, but I think that it is well worth reproducing here. From the references to flash steam, it would appear that any enthusiast trying to propel a boat by this method is a bold man indeed! Nevertheless, this article is intended to encourage more interest in flash steam, and to point out especially that it can be used in non-racing boats with great success and not too many headaches.

For anyone contemplating the construction of flash plant of any type, it is great help to know some of the possible snags. For general information on the subject I can thoroughly recommend Mr. E. T. Westbury's little book *Flash Steam* which gives much information on the history, and development of flash steam and also constructional features of various successful plants but here I would like to concentrate on some of the problems that confront the would-be flash steam exponent. Particularly I wish to differentiate between the racing and non-racing types of plant.

In the opinion of most power boat enthusiasts, the construction and development of a successful flash steam racing boat is a most difficult undertaking, and this is amply borne out by delving into past history. Since the days of S. H. Clifford's famous *Chatterbox*, which, before 1930, put up a speed of over 43 m.p.h., there have only been a handful of really successful flash steam exponents. By "really successful" I mean boats that will complete the course at high speed, and with a reasonable chance of being placed. Into this category can be placed the following:

Chatterbox—S. H. Clifford (Victoria).

Tornado series—A. Martin (Southampton).

Sea Devil series—F. Marsh (Southampton).

Ifit series—A. Cockman (Victoria).

Vesta series—F. Jutton (Guildford).

Ginger, Frisky, Eega Beva—B. Pilliner (Southampton).

In addition to this select list, the names of some experimenters who were a little less successful should also be mentioned; they include many well-known power boat exponents: C. Shackleton, A. Norman Thompson, the Best brothers, J. Cruickshank, J. Benson, G. Lines, A. Rayman, H. Turpin and C. Williams. The latest flash steam fan is J. Bamford (Aldershot) whose boat *Hero* shows much promise, but must still be placed in the second list. That such experienced model power boat men as these should be denied the complete success deserved by their fine workmanship, ingenuity, and perseverance, just goes to show how frustrating flash steamers can be. All the boats owned by the foregoing exponents showed much promise—it is the habit of flash boats to "go mad" for a lap or so, just to encourage the builder to think that he has built a record breaker!

In spite of all these difficulties, racing flash boats do exercise a tremendous fascination, and once the bug has bitten, one never really gets rid of the urge to have another attempt.

For raw beginners, a racing flash steamer is obviously not the thing to tackle, as a particularly high standard

of design and workmanship is required even to make some sort of show. The non-racing boat, however, is an easier proposition, and any existing marine engine may be driven by steam derived from a flash boiler, provided that certain precautions are observed. A fast cruising boat is very well suited for a moderately powerful flash plant, and I see no valid reason why prototype models also should not use flash boilers successfully. In cases where there is little headroom, and a low centre of gravity is required—for example, model destroyers—the flash plant is the answer to many problems, but even in other prototype boats a suitable flash boiler is easily planned.

One of the best known examples of controlled flash steam was Mr. Vines *Silver Jubilee*, which could be made to run from 5 to 15 m.p.h. simply by adjusting the heat of the blowlamp, and a more recent example is L. Gate's *Squib* 2, a launch-type craft that was described earlier this year in THE MODEL ENGINEER.

Readers who have built one of the utility marine engines described by E. T. Westbury might consider a flash boiler as an alternative to a more conventional type. A flash boiler offers constructional advantages for those who have no facilities for the brazing of a centre-flue or water-tube boiler. It is a much easier job to make the water pumps for a flash plant, than to struggle with the task of brazing a boiler with insufficient heat and equipment.

Problems

Now let us consider some of the snags that beset the flash steamer. In several case, items that are serious problems with the racing boat, diminish to negligible proportions when high performance is not required. I propose to deal only with problems involving the plant, and to split them into four groups: blowlamps and heating, boilers, pumps and engines. In each case the racing boat problems will be mentioned first, followed by an indication of what one can get away with in the tamer sort of flash plant.

In the racing boat, "keeping the boiler hot" is one of the very big headaches—in fact, it is the main reason why flash steamers start off in fine style and then often peter out half-way round the course.

The reason for this is not far to seek: a boat travelling at high speed scoops up a lot of cold air around the boiler department, all kinds of eddies are set up which affect the performance of the lamp, and in some cases the lamp cools off, resulting in large sheets of yellow flame belching from the boiler outlet as the boat slows down. The diagrams show the elementary arrangement, and also some efforts to overcome the trouble by various exponents. When one commences to box in the blowlamp, a further snag arises—the lamp no longer burns properly, and much experimenting must be done to find out how far the lamps may be shrouded. Difficulty in this respect also arises when the boat is stationary, and trouble is often experienced in getting the lamps working well before releasing the boat. In some cases, part of the casing is made to lift, so that plenty of air may reach the burner when starting up. When the boat is released, air pressure flaps down the hinged section, allowing air to reach the burner only through the comparatively restricted entrance ducts.

A mention should be made here of boiler casings. Due to the fact that flash steamers are classified by all-on weight, such items as boiler casings are usually constructed very lightly indeed. Ten thou. sheet is quite commonly used, and the thickness rarely exceeds 20 thou. Asbestos, too, is cut to a minimum in most examples, in spite of the undoubted advantages of heat conservation that a heavily lagged boiler would afford. This is one of those things that the designer must consider—whether to sacrifice efficiency for light weight.

With regard to blowlamps, the present tendency seems to favour the multiple-burner type, although a single burner with multiple jets has been used successfully in one or two cases. Pressurised fuel containers are the usual method of feeding fuel to the burners, but B. Pilliner's *Eega Beva* uses an engine-driven fuel pump for this purpose with great success. The advantage of this method is that no falling off of lamp pressure occurs—in fact, the faster the engine revs—the more fuel is pumped to the burners. The disadvantage is that yet another extra load is given to the engine, in addition to the usual water and oil pumps.

Steel tubing is mostly chosen for the vaporisers, especially where the flame comes into direct contact with the coil. Copper tubing is avoided, owing to the tendency to form scale, which may cause a blocked jet. Solid drawn annealed brass tubing is not so bad in this respect, and has been used in one or two examples.

For cruising boats, the foregoing problems fade into negligible proportions. In the first place, the speed of the boat is so much lower that there is not the equivalent of a howling gale trying to cool off the boiler and lamp, and, secondly, the fact that only a moderate performance is required from the plant makes everything much easier. Weight, too, is no longer the serious problem as with racing craft. Within reason, one can use as much lagging as is thought necessary to prevent the boiler losing heat, and the casing itself may be constructed of much stouter material.

Instead of the battery of burners or one huge multi-jet type, a single burner of moderate heat should provide all the steam required. Too fierce a flame may result in too much superheat, with disastrous results to an engine not designed to cope with it. In a cruising boat. the blowlamp should burn for some time before requiring to be refilled—some racing boats will gobble up a pint of fuel in about one minute !

The low pressure type of lamp should also be considered for the non-racing boat. Burners of the type where the flames issue from a series of slits and burn vertically are quite suitable, and are very quiet compared with the roar of the usual boat blowlamp. This is a consideration where realism is required, as in the case of prototype boats. It must be admitted, however, that some torch-type burners are noisier than others, and I have seen many prototype craft using the torch blowlamp very successfully and without the noise being too obtrusive.

The Atomising Burner

This type of burner is also a possibility for moderate performance flash plants. At least one well-known steering boat uses a burner of this type actuated by steam. In this case the boiler is, I believe, of the semi-flash pattern, but with some experimenting, I am sure that it could be applied to the flash boiler. One of the problems would concern starting the plant up. Some method of feeding the burner with air pressure before steam was generated would have to be devised.

A common failing with blowlamps is to have the burner too close to the boiler intake, and this applies to flash boilers also. With a torch-type burner, there should be a gap of about 1½ in. between the end of the burner and the intake. Less than this may result in the lamp stuttering, and failing to burn properly within the boiler casing. In general, boiler casings should be made fairly roomy, and, if the burner is to be shrouded, reasonable air space must be arranged around the whole of the flame tube.

In the racing steamer, blowlamps are usually fixed in position, and have to be warmed up *in situ*, but in the non-racing boat, it is more convenient to be able to remove the lamp when starting it up. It is also much easier to remove the jet for cleaning purposes.

Petrol is the most usual fuel for boat blowlamps, as it is less troublesome than paraffin in two respects—there is less trouble with blocked jets due to formation of carbon, and, being more volatile, the lamp may continue to work even if accidentally splashed with drops of water or perhaps cooled by a gust of wind. Under the latter conditions, a paraffin blowlamp will almost invariably stop burning, and emit large clouds of semi-gaseous vapour, followed by liquid paraffin. Any attempt to light up again after this occurrence may result in a fire in the boiler department, and possible damage to the hull.

Provided that normal precautions are observed, the use of petrol should not be dangerous, but soft-soldered fuel tanks should be avoided, except in the possible case of non-pressurised containers used with fuel pumps. Silver-soldering with one of the low melting-point alloys on a light blowlamp fuel tank should not be too difficult, even with limited heat—I managed the job once using a combination of a small gas-ring and a bunsen burner.

Touching the subject of soft-solder, I must say that it is best avoided altogether in a flash steamer of any sort. It always seems to let you down sooner or later.

Before leaving the subject of fuel, it may not be generally known that special blowlamp fuels are available which are very volatile and burn without a trace of carbon. Many flash steam exponents use this fuel and speak very highly of it. In several cases, an appreciable gain in speed was achieved while using this fuel, compared with that using ordinary petrol. I believe that this blowlamp fuel is still available from the High-Flash Petroleum Co. Ltd. of Croydon, Surrey (usual disclaimer).

Flash Boilers

A flash boiler is the simplest thing imaginable—just a length of tubing coiled up and furnished with a steam union at one end and check-valve at the other. Fundamentally it *is* as simple as this. Such difficulties that arise are mainly concerned with deciding the length of tubing to use and the arrangement of the coils—not to mention the boiler casing problems that hav already been discussed.

For the racing boat, steel tubing is invariably used, and, as difficulty is experienced in obtaining it in very long lengths, joints may be sif-bronzed or welded. Sometimes such joints are protected from the heat of lamps by asbestos, or perhaps led outside the casing. As much as 60 ft. of tubing has been used in an "A" class flash steamer, but the recent tendency is to use more reasonable lengths; $\frac{1}{4}$ in. diameter tubing is mostly favoured, but sometimes $\frac{5}{16}$ in. may be used for part of the boiler.

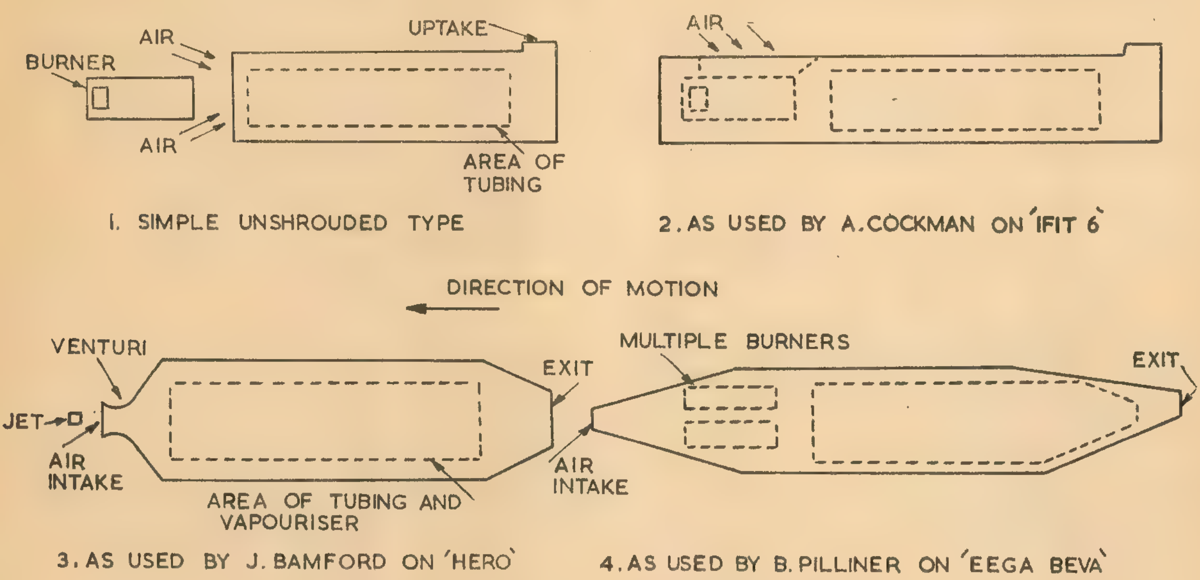
Coiling up the steel tubing is fairly easy. It may be wound cold on any suitable former, but the diameter of the former should not be less than $1\frac{5}{8}$ in. Any attempt to reduce this dimension may result in kinks, or at best, a tendency for the tube to assume an oval form. The worst job when coiling the boiler is starting the first coil, but once a few turns are wound, the rest are a simple task.

Tightly coiled boilers are regarded with disfavour, and it is the usual practice to space each coil from its neighbour so that the flames from the blowlamp spread between the coils as much as possible. As part of the boiler, at least, is usually at red heat, a snag that arises with flash boilers is the formation of scale, and many flash steam men are in the habit of disconnecting the main steam union and blowing the boiler through prior to each run. Failure to take this precaution may result in serious scoring of the valve and piston of the engine. In A. Cockman's latest boat in the *Ifit* series, a stainless-steel flash boiler has been fitted with great success. Stainless-steel is less prone to scaling, and in this boat something had to be done in order to protect the rotary-valve from the damage that had occurred when using ordinary steel tubing. An advantage which offsets the increased cost, is that the stainless-steel boiler should outlast several boilers of the ordinary pattern.

For the moderate performance flash plant, copper may be used for the boiler tubing. It has, however, advantages and disadvantages, and here they are:—Advantages: Easier to coil up; better heat conductivity; scale is softer than that formed in a steel boiler, and not likely to cause damage to the engine. Disadvantages: Unsuitable for working at high temperatures and pressures; tubing may melt if the water pump fails or engine stops while lamp continues to burn.

Except for the second item listed as disadvantages, a copper boiler should be quite adequate for the cruising boat, but that particular item is a serious one. For example, if the boat should stop due to a fouled propeller, the boiler may easily be reduced to blobs of molten copper by the time the unlucky owner has retrieved the boat.

If the burner is fed by an engine-driven feed pump, or is of the steam-fed atomising type, the problem takes care of itself, since the flame will go out automatically when the engine stops. One way of protecting the boiler where



Diagrams (not to scale), showing flash boiler casing developments

a pressurised blowlamp is employed would be to incorporate a valve to release the air pressure if the engine stops. There are two ways of doing this: mechanically or by steam pressure. The steam valve-safety device has been used on more than one boat. It is generally a spring-loaded valve arranged so that should the boiler pressure drop, the spring takes command and moves a plunger. This plunger is made to trip an air release, or the air release-valve itself may be built into the device. I must say that the examples I have seen have not been 100 per cent. reliable, being rather prone to release the lamp pressure when they shouldn't! Although I have never seen a mechanically-operated protection valve, I have a feeling that it might prove successful. A device could be designed on the governor principle, in such a way that if the engine revs. slowed beyond a certain minimum, the governor operated the air release.

The length of tubing required for the flash boiler of the non-racing boat is nothing like that necessary for a high performance plant. Ten to fifteen feet of either copper or steel tubing should be ample for most purposes. The possible exception to this might be the fast launch-type craft, where a speed around 12 m.p.h. was required.

A word now about the pressures attained in flash boilers—a subject about which there has been some controversy in the past.

I read a reader's letter in THE MODEL ENGINEER of many years past, in which it was stated that high pressures were not reached in flash boilers and quoted in support of this tests made on a flash steamer in which the pressure was only 30 lb. p.s.i., although the boat had a good turn of speed. This example is fairly easily explained, however, since the engine was a 4-cylinder job of large total capacity, and must have used up the steam almost as fast as it was generated, so that high pressure could never be attained.

At the other end of the scale, I have the assurance of Mr. J. Bamford that he recently connected a pressure gauge reading to 1,000 p.s.i. to the water end of *Hero's* boiler—result—one wrecked gauge!

The fact is that a flash boiler can be operated at various pressures, and it depends upon several factors—steam consumption of engine, heat available, and amount of water fed to the boiler, whether the plant operates on high or low pressure. This valuable flexibility can be utilised by the power boat exponent, so that the flash plant is a feasible proposition for any craft in which there is sufficient room for installation.

Before ending the discussion on boilers and heating problems, I must say how much I enjoyed Mr. Bamford's article describing his ingenious wind-tunnel apparatus which appeared earlier this year. The "mystery of the missing heat" has always plagued flash steamers, and a device such as that described might well provide the answer to a query that has puzzled constructors since the early days of flash steam.

In the next "Model Power Boat News" I propose to discuss the problems concerning the pumps of flash plants, and hope to show that these, too, are not nearly such a bogy when applied to the cruising boat.

A HAND MICROTOME

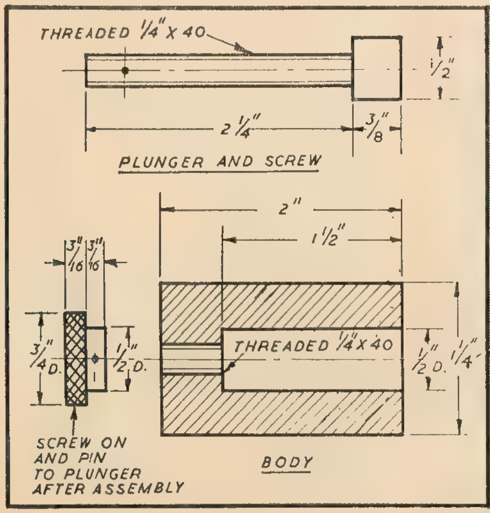
By A. L. Primavesi

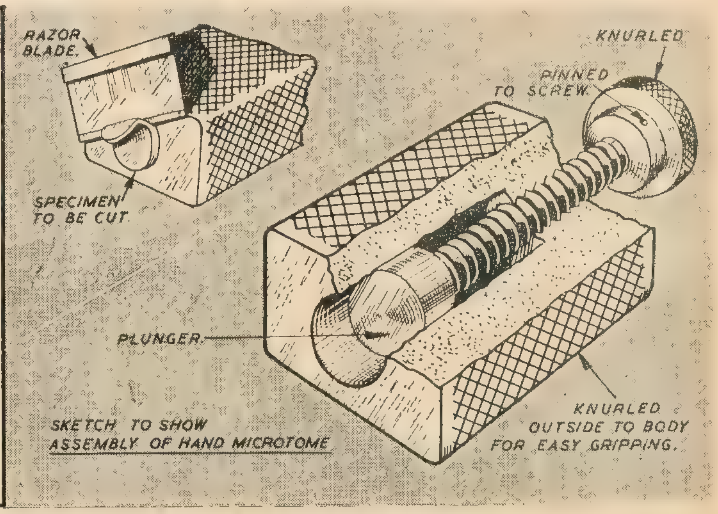
ANYONE who has been inspired by Mr. Sparey's series of articles to construct a microscope, or who already possesses such an instrument, will sooner or later wish to cut thin sections of plant or animal tissue for microscopic examination. The construction of a mechanical microtome is not beyond the capabilities of a good craftsman, but a hand microtome can be made in a couple of hours or less, and is quite a serviceable instrument.

Little description is necessary, as the drawings are self-explanatory. The plunger and threads should be carefully made and fitted, and the whole thing should be made of some non-rusting material. The body should be knurled for convenience in gripping.

As a refinement a micrometer sleeve could be fitted, graduated in thous. if a 40 t.p.i. screw has been used, or, if a fine metric thread is available, in μ, which is the normal unit for this type of work.

The sections are cut with a razor, preferably hollow ground on one side only. The flat surface of the instrument guides the blade, and the thickness is regulated by the screw. It is easy, after a little practice, to cut beautiful, even sections. The whole process, including the staining and mounting of the sections, is described in standard books on the subject, such as Peacock's *Elementary Microtechnique*. It is an interesting and fascinating process, and opens up an endless field of investigation into the wonders of nature.



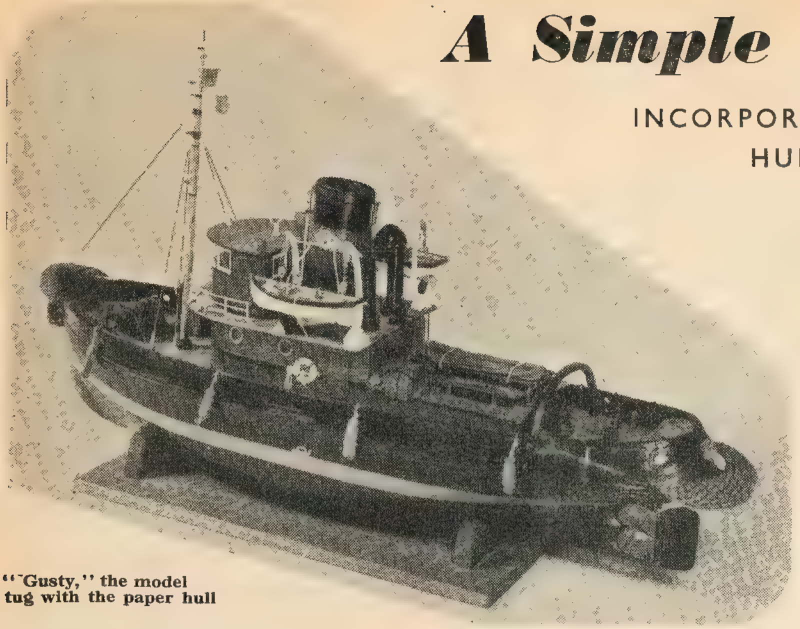


Dimensional details and perspective sketches, showing the construction of a hand microtome

A Simple Model Tug

INCORPORATING LAMINATED PAPER HULL CONSTRUCTION AND ELECTRIC MOTOR DRIVE

By J. C. Hool

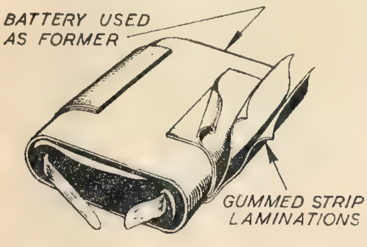


"Gusty," the model tug with the paper hull

FOLLOWING the article in THE MODEL ENGINEER in Volume 110, No. 2748 dated January 21st, 1954, describing a simple method of constructing boat hulls out of gummed sealing tape, I received many requests through my firm, Chloride Batteries Limited, for drawings of the tug *Ranger* that was illustrated in the article referred to. I rarely, however, build model boats of this type from drawings.

A number of readers no doubt will have seen the tug *Gusty* performing on the tank at this year's "Model Engineer" Exhibition and although, again, *Gusty* is not built to any known design, I feel that this photograph of the boat will help those who might wish to build such a model for the youngsters—or perhaps himself! Incidentally, since the "Model Engineer" Exhibition, *Gusty* was inadvertently dropped down a flight of concrete steps, and ended at the bottom of the stairway in what at first appeared to be a tangle of wreckage. However, upon close examination it was found that the hull itself was perfectly intact, and this speaks highly for the method of construction.

At the "Model Engineer" Exhibition, we were asked for certain details that would help in building *Gusty*, and the following information may be useful. The fenders, although resembling an eight-strand square sennet, were in fact made by the old "French knitting" method, i.e., a cotton reel with four pins spaced round the centre hole (apply for further details to wife or female relative). Fenders at bow and stern were needle-hitched on to cork formers, but once again do not let this put you off—it can be done by the girl friend with a crochet hook. The seating for the mast (a small gummed paper collar) was stuck on the keelson inside the hull before painting. The stays for the mast are made of "shirring elastic," and I have found this particular method of staying very useful where the model may be handled by young fingers. Deck-house, bridge and engine casing are built up on a wooden frame, using 1-millimetre plywood. Lifeboats were,



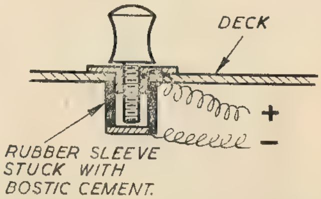
of course, built on a mould, using gummed paper in two layers—one athwartships, and the final layer to imitate the strakes of a clinker-built boat. The davits and chocks were cut with a fret-saw from celluloid. I find this medium very useful on a model of this type, because of its resilience. A number of people commented on the very realistic steam pipe to the whistle. This is merely a piece of a guitar string, which when painted white, resembles closely the lagging, that is often wrapped on such pipes.

Gusty was driven by a Frog "Revmaster" motor, and powered by a single F40 Drydex flash-lamp battery, this giving two hours continuous running. The battery was held within the hull by a gummed sealing-paper clip, this being made by merely wrapping the gummed strip round a battery, and cutting the top away to give a partly closed "U" section.

The painting was carried out after this clip had been stuck in position within the hull with cellulose glue. The motor is seated on plastic wood on the bottom of the boat, being at the same time lined up with the stern-tube and shaft. To ensure that the motor remains in position, it is only necessary to provide a simple spring hold-down arrangement from the inside of deck on to the top of the electric motor. Any excess plastic wood round the engine seating may be trimmed off before the wood finally sets. The drive from the engine to the propeller shaft is taken by a length of rubber tubing. This can be stripped from any old piece of insulated wire, but you will find that it is best to use rubber-covered wire rather than plastic, because rubber is much more pliable.

Having had trouble in the past with capstan-type switches being screwed down too tightly, I now invariably fit a switch which incorporates rubber, both as a means of insulation, and to take care of any rough treatment it may receive. The sketch will illustrate this method.

I have found that both oil and cellulose paints are quite suitable for making paper hulls and fittings impervious to water, but on *Gusty* I used cellulose brushing enamels. The hull was black, with waterline band in red. Wooden deck and bridge-deck—planks were lined in pencil and decks shellacked. The main part of the woodwork on deck-house and bridge was painted dark brown, with the relief given by black, and on the bridge windows, white. The funnel and ventilators are black with a red band.



Should any of our model engineer friends not have a copy of the January 21st, 1954 issue of THE MODEL ENGINEER, I still have a few leaflets outlining the method of making hulls from gummed sealing tape which were distributed at the 1953 "M.E." Exhibition, and I should be glad to send one of these leaflets to anyone interested.

An Exhibition

Reported by '

A HOBBIES EXHIBITION, organised by the town's Rotary Club, was held recently in Wigan, and among the many societies taking part were the local model engineers. This club is a very active one, with a fine outdoor permanent track, and a portable one for exhibitions and other functions. The latter was put to good use at the hobbies show.

As will be realised from the models to be mentioned, most of the Wigan lads are keen on locomotives and stationary steam-engines—an interest in which they have an excellent lead from their president, C. H. Noble.

Mr. Noble has nearly completed the fine "Royal Scot" shown in Photograph No. 6, in which the craftsmanship is beyond reproach. At the start, commercial drawings were used, but as the engine grew nearer to completion the builder grew more and more dissatisfied with it.

Correct L.M.S. drawings were then obtained, and a fresh start was made. Many of the existing parts were altered or scrapped as incorrect, and substitutes made. The result, when complete, will be an imposing replica of a handsome engine, to $\frac{3}{4}$-in. scale.

A Free-lance Locomotive

Another of Mr. Noble's engines was the nice-looking $3\frac{1}{2}$-in. gauge 2-6-0 shown in Photograph No. 8. This engine is to the builder's own design, and has cylinders $1\frac{3}{16}$ in. by $1\frac{3}{4}$ in. She is a good worker, and bears the name-plates *Hugh H. Duckworth* in compliment to a good friend and fellow-member of the Wigan club (who is also a "good worker," incidentally).

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1. Hugh N. Duckworth has chosen to model an uncommon prototype: A "Lanky and Yorky" 0-8-0

2. Saved from a dustbin, this excellent mill-engine was built by some unknown craftsman

3. This good example of "Juliet" was built by a greengrocer, Arthur Miller of Prescott

4. J. Smith made his own patterns for his excellent example of the "M.E." drilling-machine

5. Bits and pieces of the Allchin "M.E." $1\frac{1}{2}$-in. scale traction engine being built by J. S. Christopher of Ainsdale

6. The President of the Wigan Society, C. H. Noble, is building this excellent "Royal Scot" in $\frac{3}{4}$-in. scale

7. An experiment in fabrication by Mr. Noble: $\frac{3}{4}$-in. scale cylinder and crankshaft

8. Mr. Noble is also responsible for this handsome free-lance $3\frac{1}{2}$-in. gauge locomotive

at Wigan

"NORTHERNER"

The engine is fitted with a Stanier-type regulator, and Mr. Noble makes practically everything on his engines, even down to the hand-rail knobs. The small rivets on the smokebox and footplate are domestic pins, however.

Mr. Noble has carried out also some interesting experiments on fabrication of cylinders and crankshafts, and Photograph No. 7 shows the final result. The cylinder is built up from chilled phosphor-bronze bar, and has a piston which is fitted with two rings.

The crankshaft is exactly to $\frac{3}{4}$-in. scale of that of a full-size "Princess" class engine, made from company's drawings. It is built up entirely by force-fitting the shafts and pins into the webs, and is perfectly rigid and true-running.

Detailed Log-book Kept

From the time his engine (Photograph No. 9) first ran its trials early in 1947, H. Dean has kept a log-book, which not only gives full details of every run (including even the weather), but also every small mechanical adjustment made. This is an idea which can be thoroughly recommended; he has a

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complete record which eliminates all guess-work concerning the engine.

From the log-book it can be verified that at the time I saw the locomotive, she had run 391½ hours in all, which means an actual mileage upwards of 1,500. Recently, thinking that there *must* have been wear, Mr. Dean re-bushed the motion, making the bushes an "automobile" fit. Result: the engine would not run on the track because they were too tight.

So the bushes were reamed out until she *would* run properly, and were then found to be just the same sizes as those which they had replaced! I can vouch personally that the engine is in excellent

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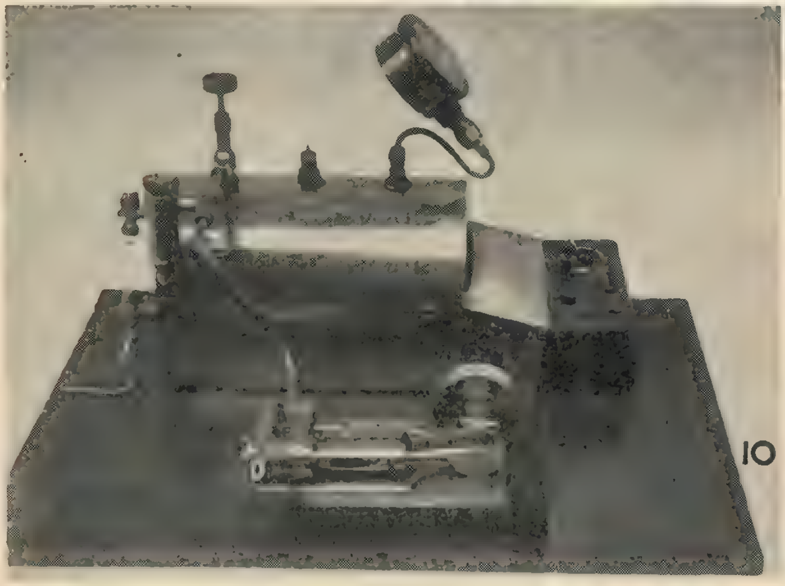

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9. **Another good-looking free-lance engine, this 4-6-4 by H. Dean has run over 1,500 miles**

10. **Particularly useful for exhibition work, this electrically-heated boiler and engine were built from scrap**

fettle, as I saw her perform on the portable track.

The engine, a 4-6-4 tank, was scaled up to 3½-in. gauge from a Greenly 2½-in. gauge outline, but Mr. Dean designed his own motion-work, and Mr. Noble designed the boiler innards. She is 36-in. long over the buffers.

Mr. Dean made patterns for the cylinders, which were cast locally in iron. They are 1¼ in. bore by 1¾ in. stroke, and the pistons—also cast-iron—are fitted with two bronze rings, which are $\frac{1}{16}$ in. by 3/32 in. section. There has been no trouble whatsoever with either rust or wear with this combination, and the pistons are still as tight as the proverbial bottle.

To some extent this can be attributed to the excellent lubricator, which has two rams, ⅛ in. by $\frac{3}{16}$ in., worked by Scotch cranks—also based on Mr. Noble's design. One ram pumps to each cylinder, of course.

A Lancs and Yorks Engine

Another engine which has done a fair amount of running is H. N. Duckworth's 0-8-0 tender locomotive (Photograph No. 1) which is a ¾-in. scale version of a Lancs and Yorks goods prototype.

With its eight coupled wheels of medium diameter, this engine is very powerful, and makes an imposing job. She is fitted with Joy valve-gear to the inside cylinders.

Mr. Duckworth also exhibited a horizontal steam engine, which had been rescued some time ago from a dustbin by a refuse collector, together with its boiler. The dustman notified Mr. Duckworth of his find, and the latter gave it a very much needed cleaning and overhaul, resulting in a very handsome little engine being saved from a nasty fate.

No details are know of the model's origin, of course, but one theory is that it was built by an employee of the Haigh Foundry at Wigan, which closed down late in the nineteenth century. It may well have been based on a prototype in the foundry itself, in fact.

The engine is very nicely built and detailed, with a mahogany-lagged cylinder fitted with a neat stop-valve. Stephenson link-motion is fitted, and the connecting-rod is fish-bellied. It would be interesting if any reader could throw any light on the origin either of the model or the prototype.

Incidentally, how many more excellent models, one wonders, have met the fate that this one, by chance, escaped?

Electrically-heated Boilers

Photograph No. 10 shows one of the two electrically-heated boilers exhibited by J. L. Waterhouse, one with the horizontal engine shown, and the other with a vertical. Both engines and boilers were made principally from scrap materials; for example, the pressure-gauges originally saw service on car dashboards, and the cylinder of the horizontal engine is part of the hinge on a gunpowder wagon.

Three soldering-iron elements are used as the heating source, and full working pressure is raised in a few minutes. The engine can be started on a few pounds, and pressure will continue to rise rapidly, until a happy balance is achieved between engine speed and rate of steam generation, by use of the screw-down regulator.

When the water-level is down to the bottom nut of the guage, the juice is switched off, when the engine will still carry on running for several minutes on the accumulated pressure.

This boiler has seen considerable service in its life of upwards of four years, and has given no trouble nor needed any replacements. Mr. Waterhouse has promised to write up the constructional details for THE MODEL ENGINEER, and I know they will interest many readers. Such a unit can be of great value not only as a test boiler, but also for use at exhibitions.

(*Continued on page* 747)

Historical Models

SOME EXCELLENT EXAMPLES DESCRIBED BY "HALLAM"

IN the prototype, the cams fit into rectangular sockets cast into the periphery of the ring. To do so in the model, though, would mean the use of complicated patterns and core-boxes, so the rings were made in two halves (see photograph of patterns). The iron castings were turned up to fit each other, and then the sockets were end-milled out ½ in. wide and ⅜ in. deep, the work being held on the vertical slide.

Cams were filed up from ⅜ in. square section silver-steel, and fixed in the sockets with 2-B.A. socket-head screws —a refinement not dreamed of by our forefathers ! The two halves of the ring were fastened together by ¼-in. B.S.F. socket-head screws from the back, where they were out of sight, but the holes were flushed off with Loy plastic metal. Wooden wedges were now driven into the ⅛-in. gap left in the sockets, as in the prototype.

There are fifteen cams in each ring, and the rings are staked on to the shaft so that the cams alternate; that is, first one hammer is lifted, and then the other, alternately.

The flywheel is simply an iron casting, and needed no treatment but filing-up. It, too, was staked to the shaft.

Method of Driving

As already stated, it was realised that the water-power alone would not drive the model, and so an inconspicuous method of driving by electric motor was needed. This was further complicated by the fact that the camshaft only needed to turn at 6 r.p.m. to give the correct speed of 90 blows per minute on each hammer; with gearing of approximately 3 to 1, this meant that the speed of the waterwheel would be 2 r.p.m.

Two or three different methods were considered, but eventually the wooden camshaft was cut short just behind the flywheel, and an elongated journal forced into a hole bored in the end, with a pin through the whole to secure it. On the journal was mounted the spur-gear (which started life on a wringing machine, incidentally), and a commercial die-cast pulley.

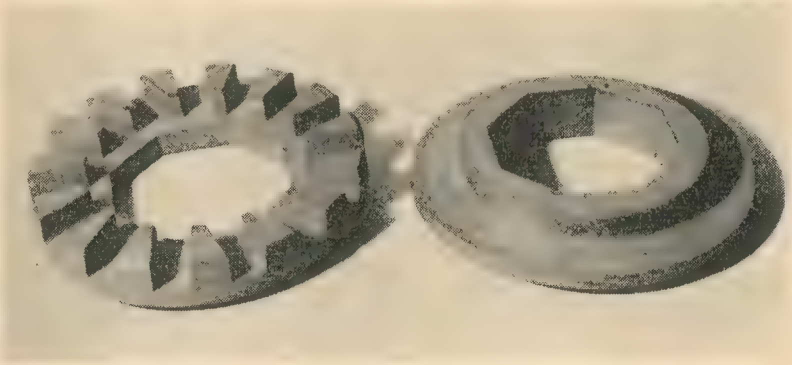
From the latter a ½-in. vee-belt was taken to a similar pulley mounted on the shaft of an electric motor, geared down to 6 r.p.m. and mounted below the baseboard. The drive cannot be seen, and the system has the advantage that although apparently the water-wheel drives the camshaft, in actual fact the reverse is the case, which means much less strain on the wooden cogs.

In the prototype, of course (just to get the record correct), the spur gear is cast with an octagonal bore, which is staked on to the camshaft in the same way as the flywheel and cam-rings. However, the deception is not visible, because the boss of the flywheel conceals the fact.

The Hammers

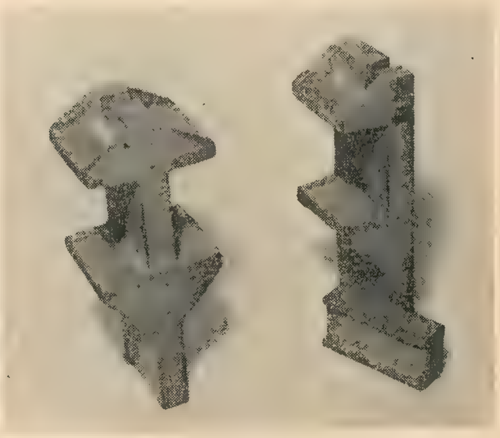
The heads of the hammers were milled (in the lathe) from solid steel, and the shafts or helves were cut from an old shovel-handle of ash, The pivots were turned from ⅜-in. square mild-steel, and were driven tightly through square mortises chopped through the

Continued from page 699, December 16, 1954.

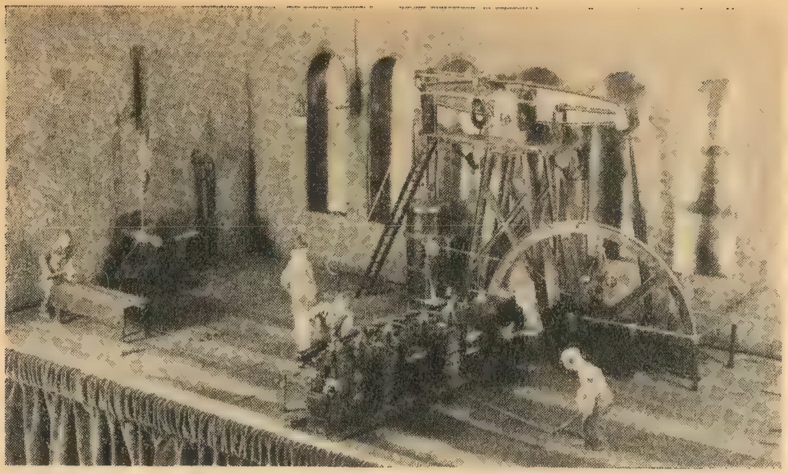


Patterns for cam-rings

Patterns for roller, cam, and bearings for both wheel-shafts: Two right-hand and two left-hand segments for small water-wheel



Patterns for standards and pivot-bearings



Inch-scale model of old-time rolling-mill, with 24 h.p. beam-engine

shafts. Iron bands reinforce the helves at intervals.

Bearings for the pivots are cast-iron blocks, carried in cast-iron standards, which are tapped at the bottom end and secured to the baseboard with $\frac{5}{16}$-in. B.S.F. set-screws from underneath. As in the prototype, the tops of the standards are tied together by dovetailed iron bars, beside which are wooden troughs (hollowed from a solid baulk) from which the hammer-bearings are water-lubricated by short pipes. The bearings are held in the standards by wedges and wooden packing.

Since the model was to work throughout the exhibition, with 180 blows per minute, it was anticipated that the nerves of the stand personnel might become a little frayed if steel anvils were used. They were, therefore, replaced by hard rubber ones, which naturally reduced the noise considerably and enabled business to be conducted without recourse to raised voices.

Water System

Again to keep the record clear, it should be understood that in the full-size works, the water-wheels are usually outside the house itself, but, of course, this would have reduced the effectiveness of the model by half. At Abbeydale, the works are built just below the dam which holds back the water, and the water is led from the reservoir to the penstock through a goit. This has sides of cast-iron panels bolted together, and top and bottom of wooden planks; the construction of the pentstock is similar, and the whole is carried on wooden framing.

The penstock for the smaller water-wheel is similar again, but the goit to this is of cast-iron pipes, flanged and bolted together.

In the model, all this is faithfully reproduced, except that the panels are cast in brass, and the pipe is of brass, with dummy flanges slipped over it and soldered in place. The "reservoir" is a zinc tank concealed behind the end wall of the "building." When the water has run over the wheels from the sluices, it flows from the wheel-pit into a tank beneath, from which an electrically-driven pump returns it to the upper tank.

The large wheel is a "ten-o'clock" wheel—so-named because the water flows on to it at that position of the circle, and the smaller wheel is "overshot"; that is to say, the sluice is above it, so that the water shoots over the top of it. Thus the wheels revolve in opposite directions.

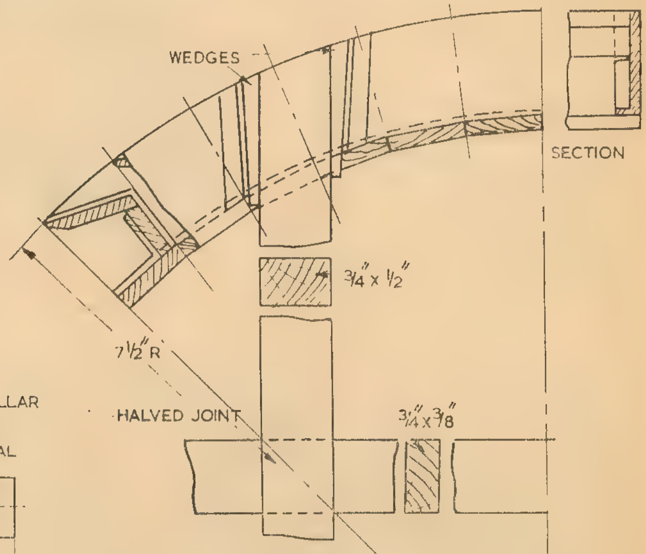
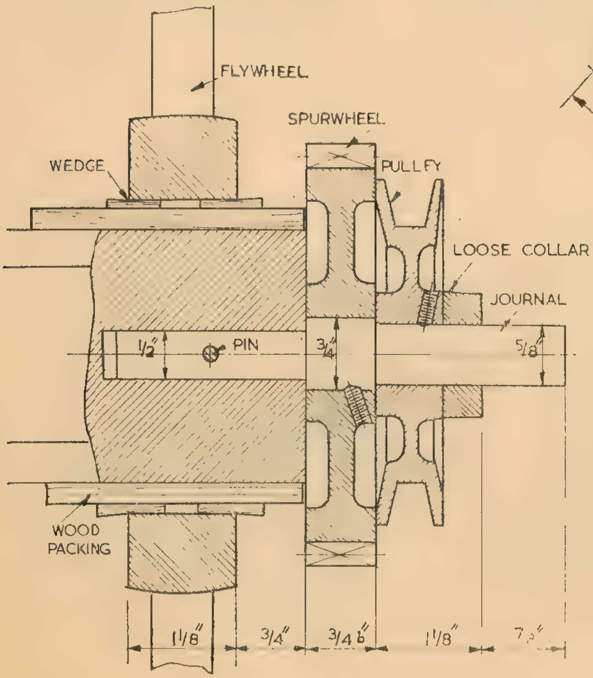


Fig. 7. Arrangement of segment and buckets of small water-wheel



Left—Fig. 6. Arrangement for driving camshaft from concealed motor

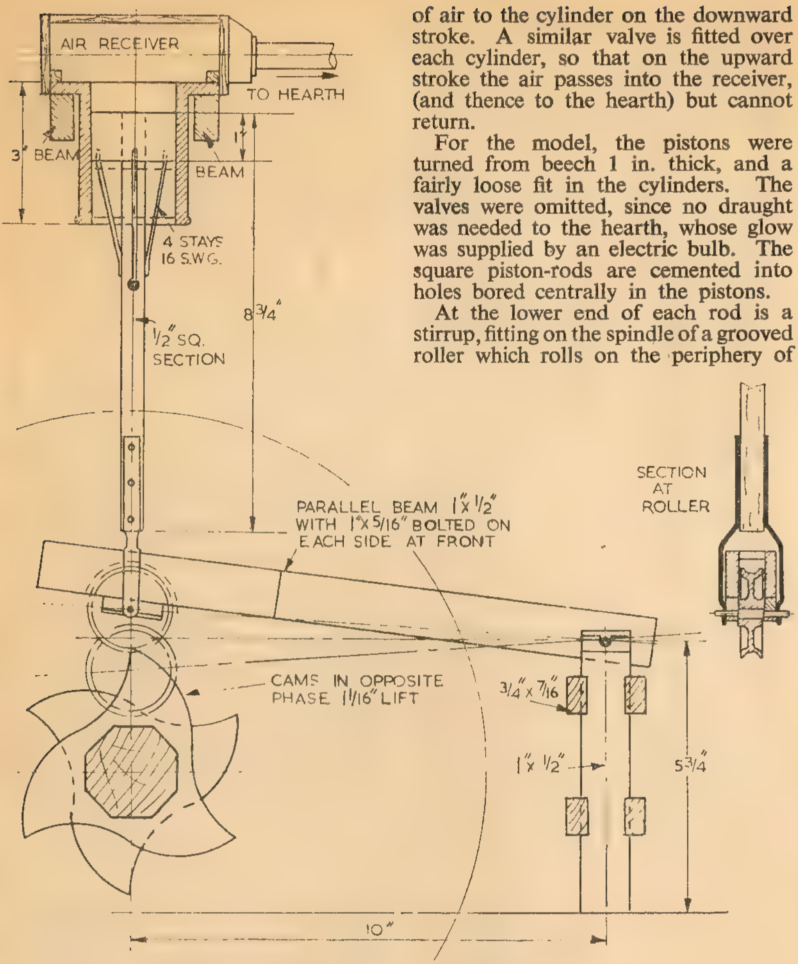


Fig. 8. Arrangement of blowing apparatus. Dimensions are for one-inch scale

Blowing Apparatus

Driving the blowing cylinders is a water-wheel 15 in. diameter by 2⅝ in. face, of clasp-arm construction; that is, with arms cross-halved similar to the cog-wheel. Each side of the rim is built in eight cast segments, jointed to the arms by bolts and wedges. Riveted plates join the segments together.

The buckets are somewhat deeper than before, and the narrow radial boards are slotted between two ribs, and held by the outer plank which is bolted on as before. The wheel is staked on to packing cemented to the shaft.

Two " three-cornered " cast-iron cams are also staked on to the shaft. The shape is so designed that the cam gives a steady lift to the blowing piston; this then falls quickly, to be arrested and steadily lifted again. Since the cams are mounted in opposite phase, a steady air pressure is supplied to the hearth.

In the prototype, the blowing-pistons are of wood, packed with hemp, and each carries a flap-valve for the ingress of air to the cylinder on the downward stroke. A similar valve is fitted over each cylinder, so that on the upward stroke the air passes into the receiver, (and thence to the hearth) but cannot return.

For the model, the pistons were turned from beech 1 in. thick, and a fairly loose fit in the cylinders. The valves were omitted, since no draught was needed to the hearth, whose glow was supplied by an electric bulb. The square piston-rods are cemented into holes bored centrally in the pistons.

At the lower end of each rod is a stirrup, fitting on the spindle of a grooved roller which rolls on the periphery of the cam. The spindle also fits in bearings secured to a beam, which acts as a simple " parallel motion," the other end of the beam being supported in fixed bearings. Again to keep the record clear, in the prototype these bearings are built into one end wall of the house, and the hearth is on what would be the front wall of the model, if it had one. In the model, the hearth has had to be placed on the end wall, so the beam-bearings are mounted on timber supports notched and bolted together.

It was found actually that in this case, the wheel provided enough power to work the blowers, but as a precaution it is driven by an electric motor; the journal of the wheel-shaft is extended to pass through the back wall, and a vee-pulley mounted on the extension, behind the wall.

All the " human " figures in the whole display were made by students of the Sheffield College of Art. They were modelled in clay, fired in the kiln, and then painted. It will be noticed that the two forge-men, or " tilters," are seated on peculiar swinging seats, slung from an overhead beam. In front of the anvils, the floor is sloped, corresponding roughly to an arc struck from the beam. Thus, remaining seated, the tilter can walk forwards and backwards, passing his red-hot bar under the thundering hammer.

There are many other details adding to the realism of the model, including dummy water-pipes, with taps, leading to the lubricating troughs and to a tub for cooling the tongs of the tilters. The floor is laid in stone slabs, with " vegetation " peeping through in places, and green " mould " is seen patchily on the walls splashed by the water. All the wooden parts were treated with brown " Presotim " wood-preservative, and the metal parts were painted with semi-matt black.

As will be realised, the model is extremely fascinating to watch when working, with the water pouring from the sluices, the stately revolution of the wheels, and the steady beat of the pounding hammers.

To any reader who is looking for an unusual subject, here is one ready to hand, and the photographs and drawings reproduced should be of great value to him, combined with the photographs in the two previous articles by Mr. Hughes. Incidentally, all the photographs given herewith were taken by him, and the drawings are all made from his originals. It is believed to be the first time that such complete details of such a prototype have been published in any journal.

(To be continued)

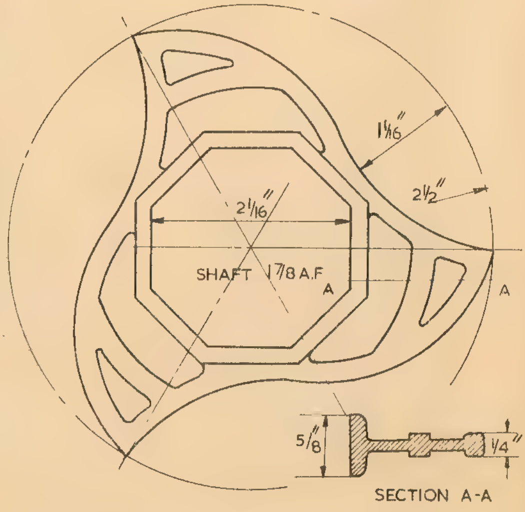


Fig. 9. Shape of cam to give steady rise and quick fall

L.B.S.C.'s Titfield Thunderbolt

TENDER BRAKE GEAR

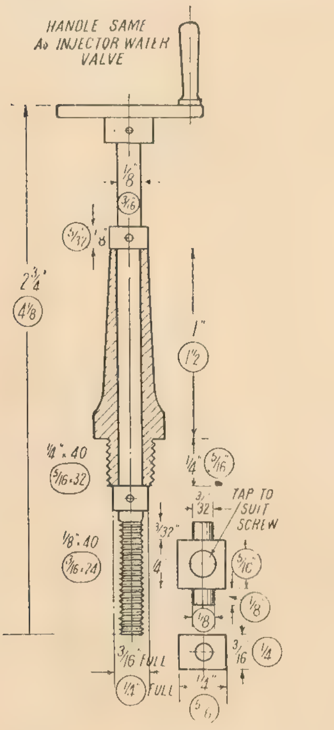
NOW we come to the last lap! I haven't seen any drawings of the brake gear as fitted to the full-size engine, nor have I seen the engine herself; the only evidence of brake gear on the drawing kindly sent to me by Mr. Riddles is seen in the general arrangement, which shows two brake-blocks, part of the hangers, and the bracket. I therefore schemed out a simple rigging which incorporates the bits mentioned above. For the sake of simplicity (apologies to a famous catalogue!) the spindle at the bottom of the brake column engages with a bell-crank mounted in a bracket attached to the dragbeam, and a rod from the lower arm of this, engages with a vertical lever on the brake shaft, so that the rod pushes the lever to apply brakes, instead of pulling it as usual. Owing to the position of the front wheels, it was impossible to fit in a cross-shaft behind the brake column spindle, and pull the brakes on; this would also have brought the pull-rod right down below the axle. The arrangement shown will be found to work quite satisfactorily, and is easy to make and erect, so let's get on with it.

Brake Column

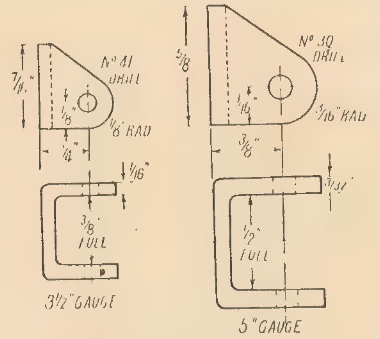
The brake column on both sizes is made from hexagon brass rod. Chuck in three-jaw, face the end, centre, and drill down with No. 30 or No. 12 drill, according to size of tender, to a little deeper than the length of finished column. Turn and screw the end as shown, then part off at 1 in., or 1½ in. as the case may be, from the shoulder. Reverse and rechuck in a tapped bush in three-jaw, and turn the outside of the column to shape shown. Make a locknut from same size hexagon rod, for securing column when erected. The spindle is just a length of mild-steel rod, screwed as shown, furnished with a handle similar to that on the injector water valve, and two small collars to prevent any up-and-down movement when the brakes are operated. The nut can be made from a small bit of bronze or gunmetal, of size shown. Chuck truly in four-jaw, face the end, and turn one of the trunnions, then part off enough to allow for the nut and the other trunnion; reverse in chuck to turn that merchant. Drill and tap the nut to suit the thread on spindle. All dimensions are shown in the illustration, which should need no further explanation.

Bell-crank and Bracket

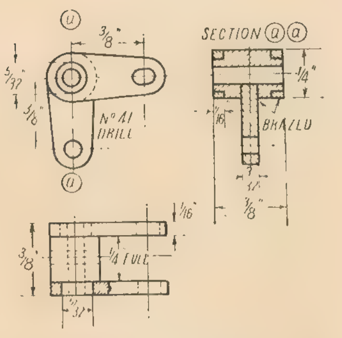
The arms of the bell-crank are just simple filing and drilling jobs, and require no detailing. The middle part is made from steel rod of diameter shown. Chuck in three-jaw, centre, and drill for the pin; then turn down the end to fit the hole in the larger end of the bell-crank arm, which should be about twice the size of the pinhole; see section. Part off to length shown, then turn the other end to take the other arm. In the middle, mill or file a slot to take the drop arm, which should be a tight fit; the slot should be cut to half the diameter of the rod.



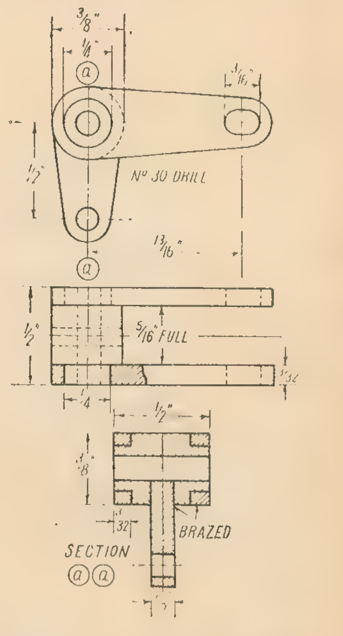
Brake column and nut



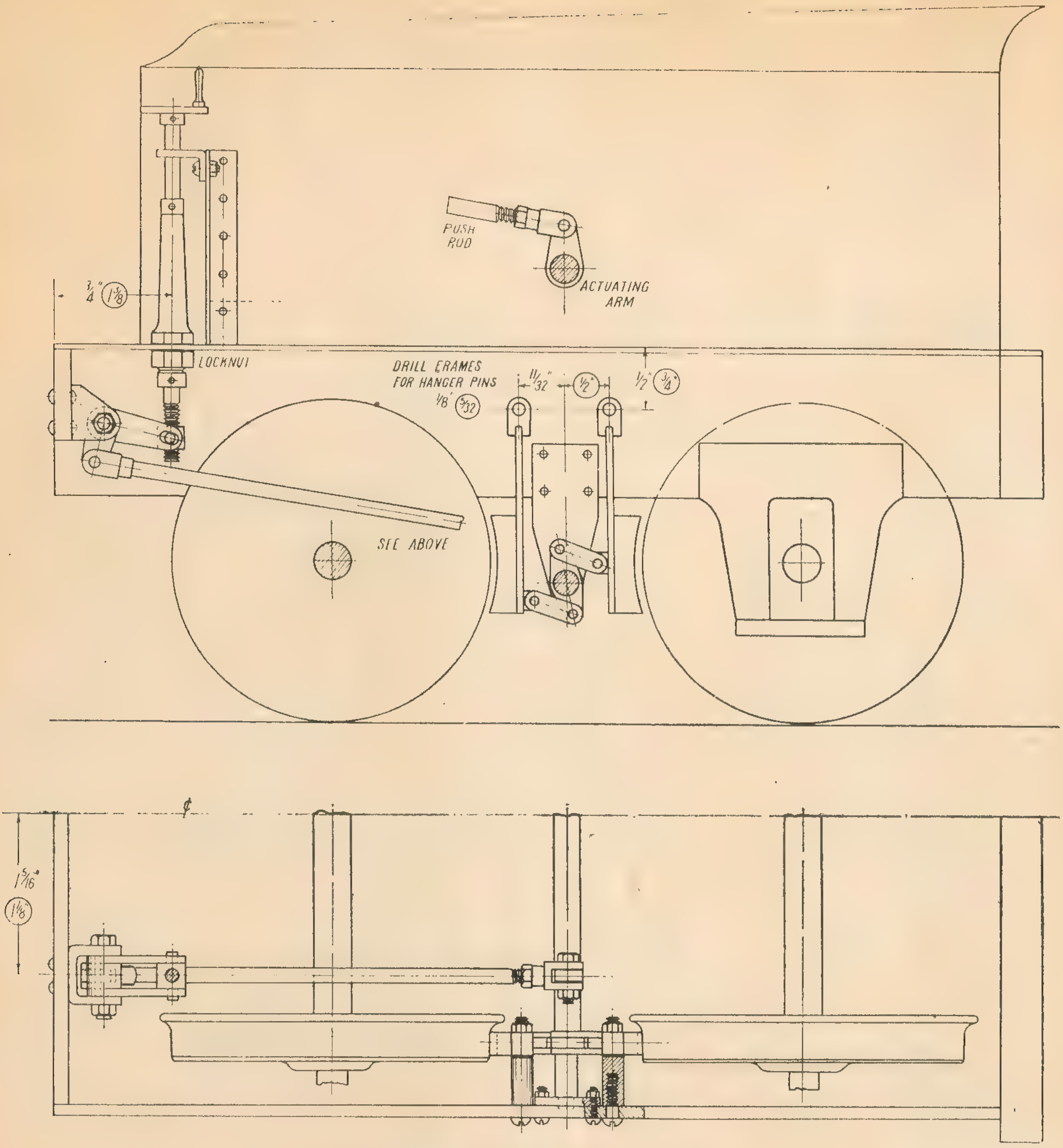
Bell-crank bracket



Bell-crank for 3½-in. gauge engine



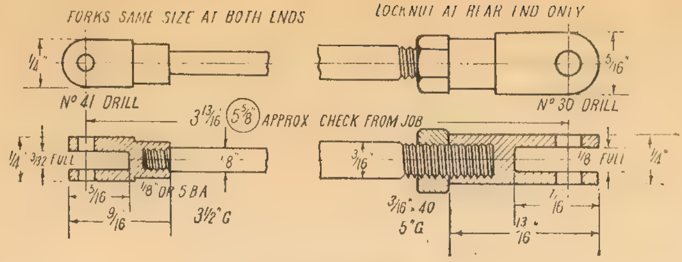
Bell-crank for 5-in. gauge engine



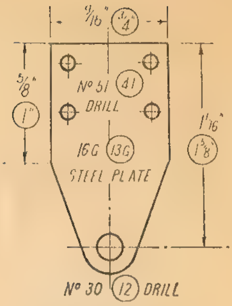
Elevation, part plan and details of the tender brake gear

Fit the arms to the middle part, taking care that the two outer arms are dead in line, and the drop arm at right-angles to them; all the joints can then be brazed at one heat. Be verra frugal wi' the brazing material, ye ken, so as to keep the job neat; just a wee fillet between levers and rod is all that is needed. Quench in water only, clean and polish up, and put the drill through the hole again to clean out the bit of the drop arm that will be projecting into it. The nut should be fitted when assembling.

The bracket is just like the kind we use when making bracket-type Baker valve-gears. All the dimensions are given in the drawings, and no special instructions are needed for such a simple job; but here is a tip: if you bend the bracket on a bit of square bar, $\frac{3}{8}$ in. square for the smaller size, and $\frac{1}{2}$ in. square for the larger, you'll automatically get the "full" measurement, and the bell-crank will fit nicely between the sides. Put it between the sides, as shown in the plan view, and secure it with a bolt made from a bit of rod, screwed and nutted at both ends, as described for valve-gear bolts. When the nuts are right home, the bolt should still be free to turn by finger pressure, so that the bell-crank is quite free to move on it; also the nut should be easy between the arms, without being slack. When O.K. take out the bolt again, temporarily remove the bell-crank, and rivet the bracket to the bottom of the drag-beam in the position shown in the elevation and plan views.



Brake push-rod



Brake shaft bracket

Brake Shaft and Brackets

The brackets which support the brake shaft are cut from sheet steel to the sizes shown, and need no detailing. Clamp each one temporarily in the position shown, midway between the wheels, with the top edge level with tops of the hornchecks, but *outside* the frame; the bolt holes can then be drilled in the frame in correct position, by putting the drill through the holes in the brackets.

The brake shaft is nothing more formidable than a piece of round steel rod, turned as shown, with the double-ended levers and actuating arm brazed to it. For the 3½-in. gauge tender, you'll need a piece of 7/32-in. round mild-steel, a bare 4⅝ in. long; and for the 5-in. job, a piece of $\frac{5}{16}$-in. ditto, 6⅞ in. long. To avoid anybody getting mixed up with the end measurements, I have shown all the dimensions for the 3½-in. size at one end of the drawing, and those for the 5-in. size at the other, both ends of the actual shafts being, of course, turned to the same measurements. If the bit of rod is held in the three-jaw chuck, the two " steps " can be turned at the same setting.

The double arms are cut from sheet steel, to the dimensions given, the middle hole being drilled a tight fit for the shaft, so that they will " stay put " whilst being brazed. It wouldn't be a bad wheeze to drill the holes first, and turn the shaft to fit, as the exact diameter doesn't matter a bean. The actuating arm should also fit tightly; and the way I usually do the job is to drill the larger end a shade smaller than the shaft, then open the hole with the " lead " end of a parallel reamer, until it will just go on the shaft very tightly. Put it on the shaft, in the position shown, and then fit the double-armed levers; the latter should be dead in line with each other, and about 11 deg. ahead of the actuating arm, as shown in the detail sketch. All three arms can then be brazed to the shaft, taking the same strict caution as before to avoid getting what the kiddies call " dollops of almond rock " all around the joints, which have to be filed off. I never have any trouble in making neat joints; in fact, my few personal friends often bring me actual jewellery jobs to repair, on the strength of my locomotive efforts. Only last week, time of writing, I fitted a snap catch to a gold bracelet for a friend of the woman next door, after two professional jewellery repairers had failed to make a job of it. The secret is: be sparing with the jointing material, and be sure you have correct heat; then the shaft won't need much in the way of cleaning up when the brazing is done. Whilst on the shaft job, cut out the eight links by which the arms are connected to the lugs on the brake hangers; these are shown in the same drawing.

Blocks and Hangers

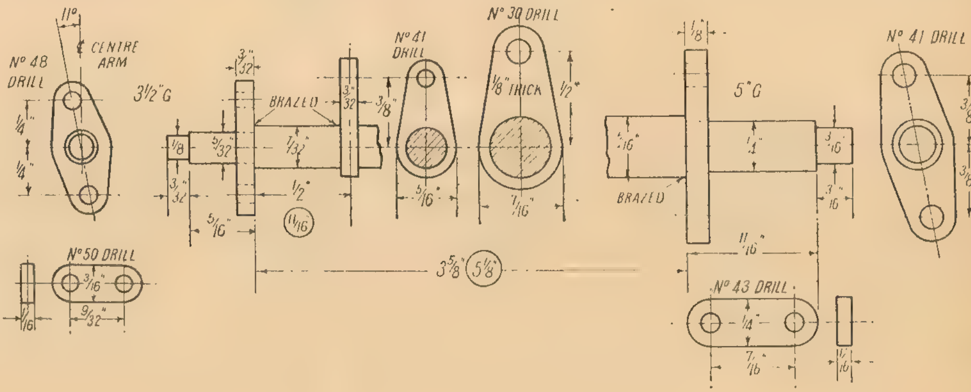
The brake-blocks and hangers look more suited to a seventeenth-century farm cart than a respectable steam locomotive; but as not-so-big sister has this type, we had better copy them, or Inspector Meticulous will be chasing us again! The hangers are made from strips of steel to the given dimensions, and each has a little block of steel brazed to the upper end, and drilled and filed to the shape shown. The lugs for attaching the brake links are just like the lugs that I specify for hanging ordinary smokebox doors, and they are made in exactly the same way. Chuck the bit of rod truly in the four-jaw, and turn the spigot to fit the hole in the hanger, which should be $\frac{1}{16}$ in. in the smaller size, and 3/32 in. in the larger, countersunk on the inside. Part off, round the end, and drill the pin-hole; push the spigot through the hole, and rivet the projecting bit into the countersink, filing off flush. Note that the front hangers have the lug at the bottom, while the rear hangers have the lug halfway up the brake-block.

The best material from which to make the brake-blocks is red fibre. Those on the big engine were of wood; and wooden ones can, of course, be used on the little engines, if desired, good hard stuff being needed. However, I use fibre blocks on my passenger-carrying cars, and find them O.K. in every way. Cut out the blocks to the sizes shown, noting that they are wider at the bottom than at the top, as the vertical hangers locate the centres of the blocks below the centres of the wheels. Fibre blocks can be attached to the hangers by countersunk screws, with the ordinary metal threads as shown; but if wooden blocks are used, they should be attached by woodscrews.

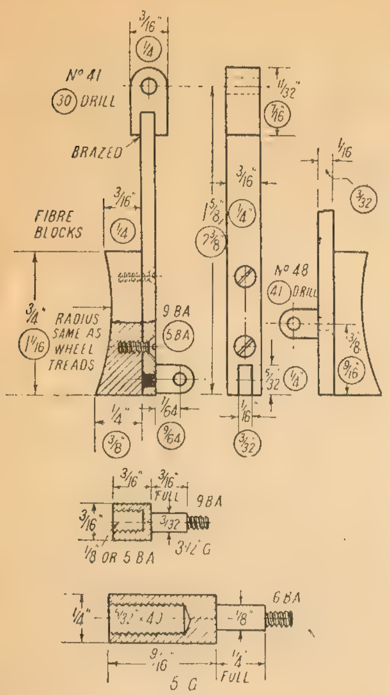
The hanger pins are plain turning jobs; and as all dimensions are shown in the illustration, no detailing is needed.

Assembly and Erection

The screwed end of the brake column is poked through a hole drilled in the tank bottom, just ahead of the division plate; the exact location of this is



Brake shaft, levers and links



Brake hangers, blocks and pins

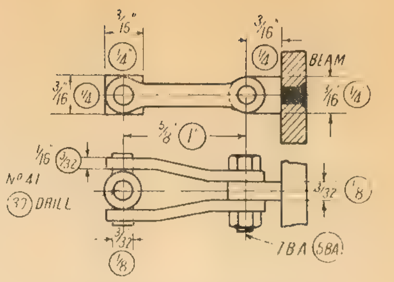
shown in the plan and elevation. It is secured at the bottom by a locknut, and steadied at the top by a little bracket exactly as described for the spindle of the injector water valve: see elevation. Hold the nut in the bell-crank against the bottom of the screw, and turn the handle, guiding the bell-crank into the bracket as the nut pulls it up; then put the bolt in.

The brake shaft, blocks, and hangers, are then assembled into one unit. Put a link at each side of the lug on each hanger, and pin with a bit of silver-steel. If this isn't a very tight fit in the holes in the links, slightly rivet the ends over, just sufficient to prevent their coming out. Pin the other ends of the links to the top and bottom of the double-armed levers in similar fashion, connecting up as shown in the elevation. All the joints should be free without being sloppy. Next drill the holes for the hanger pins in the tender frame; the size and location of these are shown in the elevation drawing. Put the screwed ends of the hanger pins through the eyes in the tops of the hangers, and put the nuts on, making sure that the hangers are free when the nuts are tight against the shoulders. Put the brackets on the ends of the brake shaft, and the whole bag of tricks can then be slid into place between the frames. Adjust position of brackets until the holes in same line up with those in frame, then secure with roundhead screws put in from outside and nutted inside. When the slots in the screws are filled up with paint they will look just like those darling pimples. Line up the tapped ends of the hanger pins with the holes in the frame, and put the screws in tightly, using roundhead or hexagon, as desired.

All that then remains is to connect the drop arm on the bell-crank with the actuating arm on the brake shaft; and this is done by a round rod with a fork at each end, the dimensions of which are shown in one of the detail drawings. The forks are made exactly as I have described umpteen times for valve-gear forks, so details need not be repeated. The thread on one end of the rod is left extra long, as shown, and is furnished with a locknut, so that adjustment can be made by taking out the bolt and turning the fork. Once the brakes are adjusted, they will probably never need further attention during the lifetime of the engine, as they are merely used for what our motoring friends would call parking. They are useless for stopping purposes, as the tender is much too light; always stop with the brakes on the passenger car.

Final Trimmings

The buffers and coupling on the rear beam are exactly the same as on the engine. The engine and tender can be coupled by a plain link, drilled at one end to suit the pin on the engine drag-beam, and slotted at the other end, like a fork, to engage the drilled lug (shown in the general arrangement drawing of the tender) to which it is pinned. Alternatively, a copy of the full-size coupling could be used, as shown; this consists of a short sleeve which goes over the pin on the engine, the sleeve having a projecting pin at each side. Two short flat links go over the pins, and the back ends of the links are pinned or bolted to the lug on the tender beam. The easiest way to make the sleeve is to take a bit of solid rod of the same diameter as the outside of the sleeve, drill it across the centre, and



Engine and tender coupling

fit a cross-pin, which is brazed in. The rod is then chucked in the three-jaw, centred, and drilled an easy fit for the coupling pin. Put the links on, rivet the ends of the pins over slightly, attach to tender lug, and the job is finished.

I don't know what colour the original locomotive was painted, so builders can choose their own colour scheme; green or brown would look very nice. Plenty of polished brasswork was the vogue in those bygone happy days; the top of the chimney, the boiler bands, the domed top of the firebox, and the splasher edges were all kept bright—a striking contrast to the practice of British Railways today, the excuse being that the engines will earn money just as well when they are dirty. I once told a B.R. official, who made that remark in my hearing, that he also could do his job just as well if he turned up at his office with a dirty unshaven face, dressed like a tramp—but he said THAT was a different matter altogether! —I wonder ? As to operating the engine, if she is fired and driven in exactly the same way as the modern locomotives that I have described in these notes, she will give many years of carefree running, and bring pleasure to her builder; and so, dear old *Titfield Thunderbolt*, Curly bids you a fond adieu !

AN EXHIBITION AT WIGAN

(*Continued from page* 740)

Allchin Traction Engine

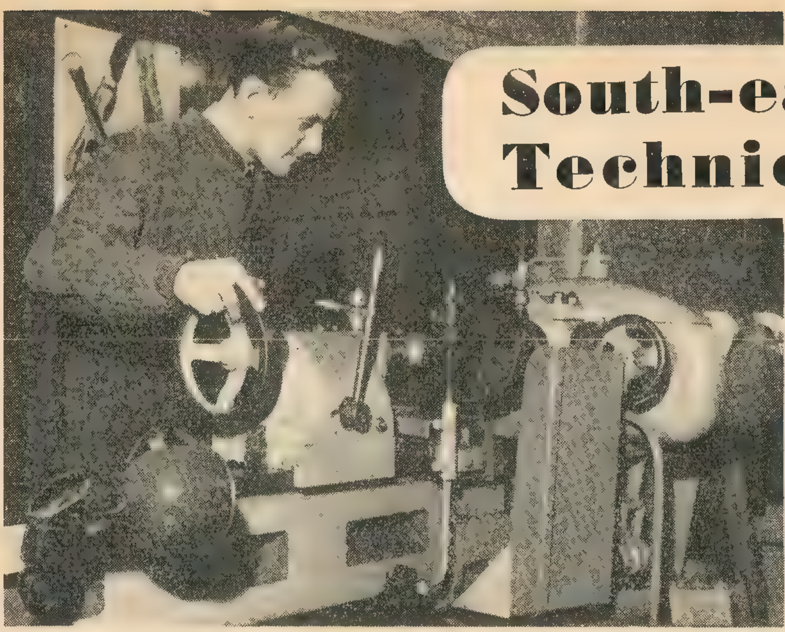
Another model on the stand was the Allchin traction engine being built by J. S. Christopher, whose parts (model, not anatomical !) are shown in Photograph No. 5. Like all the work described up to now, the standard of workmanship was very good and it was interesting to see how the model is developing.

However, we'd better not steal W. J. Hughes' thunder here, but will pass on to the only machine tool on the stand. This was a well-built example of the "Model Engineer" drilling-machine, built by J. Smith. This gentleman had made his own patterns, the castings being done at a local foundry. Slight modifications had been made, but substantially the published design had been followed, resulting in a very useful piece of equipment.

Of course, there were other examples of club-members' work on view, too, but space does not permit a description of them. However in my brief visit I did manage to see some excellent films made by Mr. Christopher of interesting activities on the club's continuous track, and these helped to confirm the impression that the Wigan lads indeed form an active society. Long may they continue to do so !

South-east London Technical College

By Antony Glasier



There are fifteen first-class lathes in the shops

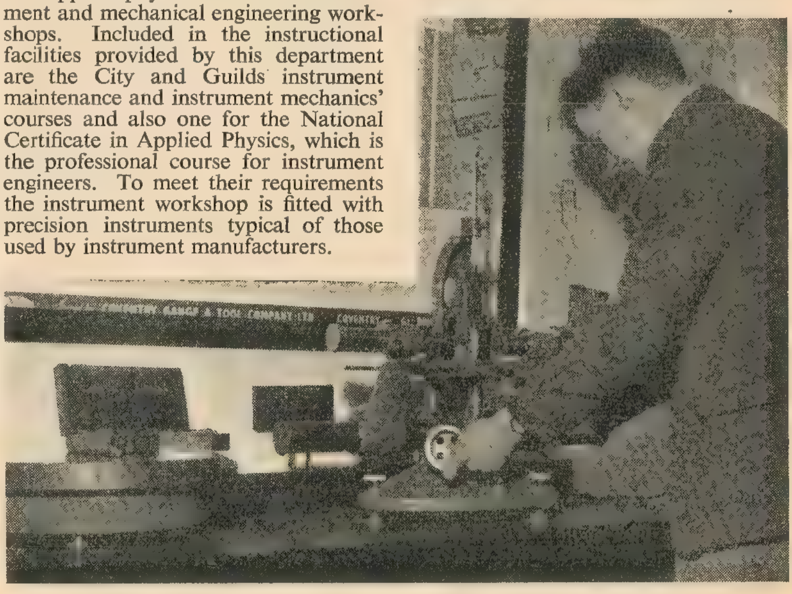
THIS college, at Lewisham Way, S.E.4, is well known far beyond its immediate locality for providing an unusual wide range of technical courses. Many of them are designed to provide a combination of electrical and mechanical engineering training in conformity with the belief of the college authorities that mechanical engineers should understand the rudiments of electrical engineering and vice-versa. Although such courses are particularly well suited to the requirements of local industry, which to a large extent consists of instrument manufacture, it is in fact the large number of students attending the college that makes it possible to form highly specialised classes which would be uneconomic at a smaller institution. It is not surprising, therefore, to learn that students come from such distant places as Luton, Southend, and Ashford.

The college is the largest and the newest of the technical colleges maintained by the L.C.C., and has a roll of over 4,000 full and part-time students, of whom 2,117 attend the electrical department, 1,394, attend the mechanical engineering department, and 465 attend the building department. Until the present building was opened in 1931, the technical classes were held at the nearby Goldsmith's College. Between then and the war, the Institute, as it was then called, expanded rapidly in numbers and courses, and also pioneered summer courses for teachers on management and welding. During the war, the workshops of the college were largely devoted to the production of armament components. The college trained many instructors for the Ministry of Labour and also thousands of servicemen and women for technical occupations in the forces. Associated with the college is a boys' secondary technical school, and adjacent is a junior college providing courses for the Royal Society of Arts technical examinations. The majority of students attending the senior college are from local firms on day-release or sandwich courses.

The combination of training in mechanical and electrical engineering is reflected in the internal organisation of the college, which is unusual in that the department of electrical engineering and applied physics has its own instrument and mechanical engineering workshops. Included in the instructional facilities provided by this department are the City and Guilds instrument maintenance and instrument mechanics' courses and also one for the National Certificate in Applied Physics, which is the professional course for instrument engineers. To meet their requirements the instrument workshop is fitted with precision instruments typical of those used by instrument manufacturers.

The outstanding feature of this department, however, is a four-year engineering sandwich course which is the only one of its kind in London and very possibly the whole country. It is designed to permit the simultaneous basic training of mechanical engineers, electrical engineers, and communications engineers, the student specialising in his own particular branch only in his third or fourth year. The students attend from their firms for full-time study on alternate weeks and an Ordinary National Certificate both in mechanical and electrical engineering is awarded to successful students at the end of their second year. At the end of their fourth year they receive a Higher National Certificate giving complete exemption from taking the associate membership examinations of certain professional institutions.

Several advantages result from this scheme. One is that students are able to make a much more mature choice of their profession than if they had to do so when initially enrolling for the course. Another advantage is that the system of alternating each week between academic and industrial training, enables theory and practice to be kept much



The value of metrology (fine measurement) is well appreciated

more in step than if the respective periods were longer. Similarly, the college workshops are utilised far more effectively, as there is no long period when they are not being used because the students are working at their firms. A variety of craft courses, such as radio servicing and cable and plumber jointing, is also provided by electrical engineering department, in addition to professional courses for engineers in all branches of the electrical industry.

Among the course run by the department of mechanical engineering is one on marine engineering which takes two years and is designed to remedy the shortage of marine engineers which affects the oil-tankers industry in particular. At present, 50 boys are taking the course, which covers mechanical and electrical engineering workshop technology and practice, engineering drawing and design, applied mechanics and heat engines, and physics and chemistry. Following the course, apprentices spend 18 months at sea and then a year on shore at a marine engineering works, when they also attend for part-time instruction at a technical institute.

City and Guild courses include those in foundry work, machine-shop engineering, motor-vehicle work, metal plate work, gas and arc welding, gas fitting and gas technology, and also refrigeration work—the college being the only institute to provide a trade course in this particular subject in the London area.

Equipment in the workshop, which is used also by students from the associated secondary technical school, includes 14 centre lathes and a capstan lathe, four planers and shapers (including a large openside shaper and a slotter), four presses (two hand and one 6-ton and one 15-ton power presses), three milling machines, three drilling machines, three grinding machines, and two gear cutters. There is also a single spindle automatic lathe, a Newall jig borer, and a broaching machine, all the machines being supported by an extensive range of tooling equipment.

The plant in the sheet metal workshop includes up-to-date plate bending and folding machinery, swaging machines, guillotine-cutting machines, and gas welding equipment, which is used also for gas fitting practice, though there is a separate gas welding and heat treatment shop, as well as an arc welding shop housing a spot welder.

Students taking the High National Certificate course in production engineering, and those studying workshop technology in the other National Certificate courses, use the workshop as a laboratory, whereby they can conduct experiments on cutting tools, feeds and speeds, and mechanical efficiency. One experiment has been concerned with measuring cylinder bores to exceptionally fine limits with workshop devices. Other advanced work has included the machining of complicated castings, spiral milling, centreless grinding and planing, precision boring, and press toolwork, etc.

A metrology room is well-equipped with electrical and mechanical comparators, toolmakers' microscopes, and a projector with distant control. The most notable item, however, is an optical interferometer made at the college to National Physical Laboratory design at a cost of £100—a saving of about £800 on what the instrument would have cost if it had been purchased commercially. It is understood that the college would be pleased to lend the patterns and drawings to any other technical institute wishing to follow their example. Other equipment includes screw thread, surface, and hardness-measuring devices.

Equipment in the instrument workshop of the electrical engineering department includes two bench millers, four bench drilling machines, a watchmakers' lathe, an engraving machine, two coilwinding machines, a polishing head, a baking oven, a finisher, a forge, several air compressors, and nickel and chrome plating baths.

Until last year there were facilities for model engineering provided in the college workshops, the boys making aero-engines and steam engines of their own choice under the guidance of the workshop instructors. Unfortunately heavy demands on the workshops for tuition have meant that this privilege has had to be withdrawn, but the head of the mechanical engineering department hopes to restore it as soon as possible because he feels that model engineering gives experience in almost every workshop process and also brings added interest and zeal to the boys' practical work.

Metallurgy is one of the subjects taught

Right: Gas welding plant is among the equipment

READERS' LETTERS

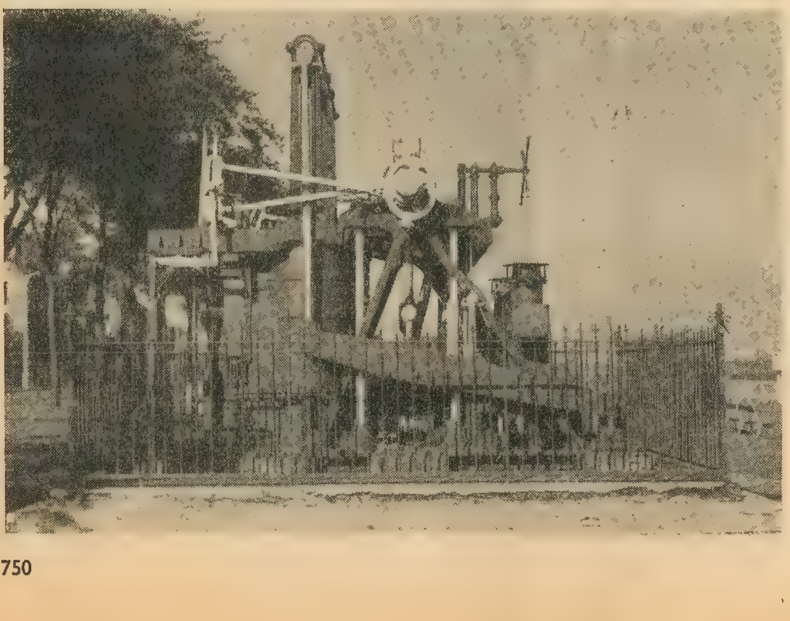
Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

AN OLD SIDE-LEVER MARINE ENGINE

DEAR SIR,—The reproduced photograph of a marine engine will, I hope, be of interest to readers.

It represents a two-cylinder engine built for the tugboat *Clyde* in approx. 1859, which stands on the "Ferry Green" at Renfrew, Scotland, and is still in excellent condition.

Yours faithfully,
Castle Bromwich. ALEC. F. FARMER.



DRILLING MACHINE CHATTER

DEAR SIR,—Regarding drilling machine chatter (Queries and Replies, THE MODEL ENGINEER, Vol. 111, p. 516, 28/10/54), it is better to drill holes straight from the solid, so that the point of the drill is supported. It is because the point is not supported, that J.S.G. is experiencing chatter. Of course, if sufficient power is not available to drive the big drill, a pilot hole may be drilled first, but let it be as small as possible. Another point which will help to avoid chatter when a pilot hole is used is to reduce the clearance on the cutting edges on the bigger drill to the minimum; this will help support the drill and also avoid it being greedy. This is a good idea to remember, to obtain a smooth finish when using an ordinary twist drill as a countersink for screw heads.

Ordinary twist drills are used with impunity today for enlarging existing holes, though three- and four-fluted twist drills are made and recommended for this specific purpose, and the ordinary twist drill should not be used; it is only because they are usually made in high-speed steel that they stand up to this abuse. If you are using carbon-steel (cast-steel) drills, do not abuse them in this manner, or you will soon rub all the clearance off. In my early days, when only carbon-steel twist drills were used, there was the very devil to pay if the foreman caught anyone opening a hole with a twist drill; an old-fashioned flat drill had to be used for this purpose.

Yours faithfully,
Wembley. J. H. DAVIS.

AIR/GAS BLOWPIPE

DEAR SIR,—My attention has been drawn to your issue of October 21st last in respect of the question and answer on page 492 under the heading of "Air/Gas Blowpipe." I write to you because your correspondent signs himself "B.S. (Woodford Green)" and is presumably a gas consumer supplied by this Board.

I am bound to draw your attention to paragraph 27 of the 3rd Schedule to the Gas Act, 1948, which you may wish to consult. It may be summarised, however, as follows:—

> A Consumer of gas supplied by the Board who uses it for working a compressor or who uses in connection with the consumption of gas supplied by the Board compressed air or any gas not supplied by the Board must if required by the Board at his own expense provide fix and maintain in proper repair an appliance which will prevent pressure fluctuation in the supply mains and any other inconvenience or danger to other consumers and the admission of the compressed air or gas not supplied by the Board into the service pipe or into any main through which gas is supplied by the Board.
>
> The Consumer must not use a compressor or any apparatus for using compressed air or gas not supplied by the Board installed by him after the 1st October, 1934, unless he has given to the Board not less than 14 days' notice in writing of his intention to do so.
>
> If a Consumer fails to comply with these requirements the Board may cut off his supply of gas and need not resume the supply until the default has been remedied to their reasonable satisfaction.

Attention should be drawn to this; otherwise, in view of the answer given to your correspondent dangerous conditions might well arise.

Yours faithfully,
BRIAN WOOD,
Secretary,
London, W. North Thames Gas Board.

MODEL S.A.R. LOCOMOTIVE

DEAR SIR,—I have read with interest the letters in THE MODEL ENGINEER by Mr. R. B. Begs in the issues of September 9th, 1954, and Mr. J. Perrier, October 28th, 1954.

I have completed the 1-in. scale "15F" S.A.R. locomotive. My frames, too, were carved from steel, but the laminated springs were made from spring-steel as specified in the drawings of Craftsmanship Models Ltd. They are entirely satisfactory. I have driven the locomotive by sitting on the tender.

The regulator as drawn was not satisfactory, as it only remained in place when minus valves; so I fitted a slide-valve regulator under the dome, worked from existing gear on the back-head. It shuts off spot tight; the original, as drawn simply would not.

The locomotive is painted blue-grey with polished stainless-steel cleading bands, and I am assured by an enthusiast, who has ridden on the footplate of the "15F" in South Africa, that it looks quite correct.

After a few runs under steam with a light load, the locomotive made no trouble of pulling 35 cwt. of iron.

It would be very interesting to know Mr. Perrier's experience with the regulator.

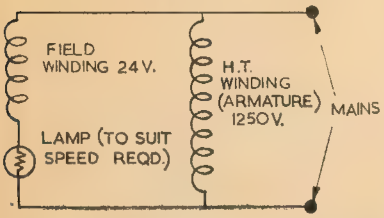
Yours faithfully,
Dartford. C. H. G. BENNETT.

CONVERTING ROTARY TRANSFORMERS

DEAR SIR,—I have been very interested in the various methods of converting surplus rotary transformers that have appeared in THE MODEL ENGINEER since the end of the war.

While living in a house on a.c. supply, I used a type 29 quite successfully to drive a small lathe, using the method of shorting the l.t. brushes and turning the end frame 90 deg.

Since coming on to d.c., however, I have found the snags of unduly high speed and lower power, in spite of trying various "dodges"—such as shunting the h.t. brushes with a 60 watt lamp, thereby increasing the energising of the field windings.



None of the experiments had been successful until I recently hit on the idea of wiring the type 29 as a shunt motor and putting a lamp in series with the field winding. This has resulted in increased power and reduced speed; in fact, with a 150 watt lamp in use, I should judge the r.p.m. to be well below 1,000, the speed being readily increased if the lamp wattage is lowered.

The power used in the lamp is not wasted, because it has now become the light for the drilling machine that the motor drives.

The temperature rise in the motor seems to be much less than formerly, so "everything in the garden is lovely!"

I am writing this letter in the hope that other people may try this method, although I am quite prepared to read in future issues that various technically-minded gentlemen condemn the method because it's all wrong, or that it has been used since the year dot!

In conclusion, I would like to record my appreciation of the numerous interesting articles that I have read in THE MODEL ENGINEER since becoming a reader in 1946; may it long continue to flourish!

Yours faithfully,
Nottingham. LESLIE T. JENKINS.

METAL PLATING

DEAR SIR,—Your correspondent, Mr. R. D. Richards, in his letter in your issue of November 11th, 1954, quotes what appears to be non-standard information in respect of obtaining silver chloride.

To prepare this substance by direct solution of metallic silver in hydrochloric acid would be most difficult, as the metal is only slowly soluble in this acid.

The usual method of preparing silver chloride for any purpose, is to precipitate it from a solution of the nitrate of silver by the addition of a solution of soluble chloride (common salt), and to decant the watery liquid from the precipitate (Ag Cl). It is then further washed, by adding clear water to the container holding it, and pouring off the clear water, leaving the white Ag Cl for use with the necessary cyanide, to make the double cyanide plating solution.

To make Ag No_3 (silver nitrate) is a messy job, and it is recommended to buy it from a chemical dealer.

Yours faithfully,
Birmingham. W. WARE.

VERSATILE TOOLS

DEAR SIR,—I felt that I must answer what appeared to me an error after reading the article on "Versatile Tools" in a recent issue.

Surely the whole matter has been inverted; instead of arguing for the "hands" in an imaginary battle between those for "hands" and those for "brains," it would have been better to have treated the subject historically and logically? The starting point is that: "Man arose from a savage animal."

From amongst the tree dwellers and climbers was to be found the species from which descended the most wonderful animal this earth has produced. Without trees to climb, the progenitors of man would never have assumed an upright position, and, therefore, the widespread growth of trees was an essential factor in his historic development. This primitive animal could neither out-bite, out-run, nor out-claw his rivals in the vicious struggle for existence, but a nimble body and brain of a superior order led to his survival and ultimate domination.

During this period the hands became free, and thus became tools for action and investigation. They are not only organs of labour but also products of labour.

This creature next descended from the trees of many shrinking forests; this relieved the hands of the strenuous actions required for tree life. An erect posture had become habitual, and thus left the hands to become more refined tools. Henceforth the hands and brain reacted on one another comparatively rapidly, and attained a marvellous co-operation which if upset or neglected will lead to deterioration. History has confirmed this in more than one instance, both nationally and individually.

A third organ now became modified and accelerated progress. The larynx developed, and a primitive sort of speech was attained which made his co-operation still more effective. It is the complete co-operation between these three which has been largely responsible for man's achievements, but it must not be forgotten that other organs have played important roles. The chief of these are the eyes, ears and nose. The truths mentioned represent only a small section of the study of the descent of man, but enough has been written to show how carefully we must deal with this subject.

Yours faithfully,
Abertillery. H. Y. DENHAM, A.M.I.E.E.

MR. HOCKING'S "CITY OF TRURO"

DEAR SIR,—I had intended to write at some length about Mr. Hocking's arbitrary and unhelpful attitude towards perfectly courteous requests for further information upon the details of the design for which he makes what I regard as somewhat extravagant claims; but Mr. Keiller's excellent letter, published in your issue of October 28th, covers most adequately much of what I wanted to say.

Designing "The Locomotive of the Future" is a most fascinating (but quite unprofitable) way of spending one's time, but I would suggest that to design such engines for conditions which are never in the remotest degree likely to eventuate is no more fascinating and even less profitable than to design them for conditions which *do* exist, or may be presumed likely to exist, in the foreseeable future.

Mr. Hocking's *magnum opus* would require the re-laying of thousands of miles of track, the reconstruction of thousands of over-bridges and, in spite of his asseversations, the enormous structural operations necessary to increase the loading gauge.

Such operations do not appear to be practical politics, nor does there appear to be the slightest warrant for them, anyhow. Furthermore, there does not appear to be the need, now, or in the future, for locomotives of such horse-power under conditions in Great Britain.

Undoubtedly, British railway engineers would have been in a much happier position today, if Brunel rather than Stephenson had won "the battle of the gauges"; but he didn't, and the restrictions we now endure are likely to continue in the future, and to ignore them is to indulge in wishful thinking.

If people are going to adopt the attitude that your readers must take on trust revolutionary designs, which, incidentally, bear no relation to anything in the least likely to be constructed, and are to be met with a point-blank refusal when they ask for details, then I would quite seriously suggest that the space taken up might be more usefully applied.

Mr. Keiller dealt with the dimensional questions; the only contribution I can offer is to suggest that, amongst other surprising features, Mr. Hocking proposes to use rubber connecting-rods and rubber-spoked wheels. Mr. Keiller's reference to science-fiction would seem admirably to sum-up the situation.

Yours faithfully,
Rustington. K. N. HARRIS.

WITH THE CLUBS

South London M.E.S.

The next meeting of the society will be held on Sunday, January 2nd, at the White Horse Hotel, Brixton Hill, S.W. at 11.0 a.m.

The meeting will be an open discussion on the proposed permanent track when Mr. R. L. Pennington, A.M.I.W.M., will outline his views and suggestions, all members should make every effort to attend.

Several interesting meetings for the coming season are now being arranged, details of which will be given later.

Full particulars of the society may be obtained on application to the Hon. Secretary: W. R. Cook, 103, Engleheart Road, Catford, S.E.6.

Hastings and District M.E.S.

Members recently had the pleasure of making a visit to the new power station at Portslade-by-Sea. A very pleasant afternoon was spent, and we were given a thorough tour of the station. This was particularly interesting, as we had visited one of the older stations some eighteen months ealier, and it gave us the opportunity of seeing the great improvements which had been made in this industry.

Early in the New Year we are looking forward to our annual talk from Mr. R. A. H. Weight on his tours of British Railways during the past twelve months.

The model race car meetings will shortly be resumed in the Bowls Pavilion, Falaise Road.

Hon. Secretary: W. Brogan, 4, Mount Pleasant Road, Hastings.

Eltham & District Locomotive Society

The next meeting will take place at The Beehive Hotel, Eltham, on Thursday, January 6th, 1955, at 8.0 p.m. and will be an "Any Questions Night," conducted on similar lines to the B.B.C. Television. Members are asked to make a special effort to attend this session and make it a success, and those with workshop and construction problems are asked to come forward and put their questions to the panel. This should be an interesting evening.

The recent Rummage Sale was very successful, every article being disposed of. Visitors are always cordially invited to the meeting.

Hon. Secretary: F. H. Bradford, 19, South Park Crescent, S.E.6.

York City & District S.M.E.

Our first meeting in the new year 1955, will be held on January 8th at 7.0 p.m. in the Rechabite building, Clifford Street, York, and will be devoted to a talk and demonstration of "Tape Recording," by Mr. David Dobson.

A series of talks on model boat building, to include the modern fibre glass process, will commence on January 22nd.

On February 5th, a short film show will be given by Mr. Dobson. Come and see yourselves as others see you! This meeting will also be a models night, so bring something along.

All old members and visitors will be welcome at these meetings.

Hon. Secretary: W. Shearman, 28, Terry Street, York.

Bournemouth & Christchurch M.E.S.

The Bournemouth Model Power Boat Club has now changed its name as above, to foster interest in the following: model power boats, R.T.P. and S.R., model cars, locomotives, etc.

Anyone in or around Bournemouth with interest in the above would be welcome on club night, which is held at the White Hart Hotel, Barrack Road, Christchurch, 7.30 every other Wednesday.

For further details contact Hon. Secretary: A. F. G. Hardy, 22, Ramsdown, Hurn, Nr. Christchurch, Hants.

The Junior Institution of Engineers

Friday, December 31st, at 7.0 p.m. Pepys House, 14, Rochester Row, S.W.1. Popular Film Evening—"Sweet Thames Run Softly," "West Country Journey," "Spinning Wheels."

Midland Section. Wednesday, January 5th, at 7.0 p.m. at the James Watt Memorial Institute, Gt. Charles Street, Birmingham. Ordinary Meeting: Paper—"Power Press Safety," by J. H. Price (member).

Friday, January 7th, at 7.30 p.m. Pepys House, 14, Rochester Row, S.W.1. Film Evening.

CORRESPONDENCE

The Managing Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Correspondence and manuscripts should not be addressed to individuals, but to the Managing Editor, The Model Engineer, 19-20, Noel Street, London, W.1.

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Buck & Ryan for Lathes and Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone Euston 4661.

Rebuilt Lathes. The Acorn Machine Tool Co. (1936) Ltd., offer rebuild to limits "Acorntools" and "Atlas" 10″ swing s.s. available. Write—610-614, Chiswick High Road, W.4. (Phone: CHI 3416).

Perfecto Engineering Co. (Machine Tools). Hoover motors, Burnerd chucks, cash or terms. 20 D.P. gears suitable for most types of popular lathes. Castings, etc. for our 4″ lathe, 5″ stroke power shapers. Lists 6d.—60, Stanley Street, Leicester. Phone 20078.

Whiston for Nuts, Bolts, etc., rivets, 1/32″ dia. up, plastic belt, silver-solder, silver-steel, screwed rod, ball-races, etc., Send for 1,000 items list.—K. R. Whiston, (Dept. M.E.S.), New Mills, Stockport.

Diadisc grinds small carbide and steel tools, corundum, etc., quickly without heat. Leaflet available.—W. J. Millett, C.M.B.H.I., St. Ives, Huntingdon.

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Next advert January 6th, 1955

Immediate Delivery from Stock. Myford "M.L.7" and "Super 7" lathes, Grayson, Super Adept lathes, bench planer, shapers, electric motors, small tools.—F. W. Kubach, 12, Sylvan Road, London, S.E.19. LIV 3311/12.

"Acorntools" and "Acorntools" De Luxe 5″ s.s. and s.c. lathes, also "Acorntools" 7″ stroke high-speed shapers and ½″ capacity capstan lathes can be supplied *ex*-stock. Hire purchase terms available. Send for literature and full details to the manufacturers of these machines.—The Acorn Machine Tool Co. (1936) Ltd., 610-614, Chiswick High Road, Chiswick, W.4. Tel.: 3416-7-8-9.

Sale. Sylvan Planer/Shaper. Almost new, £20.—Dean, 89, Wistaston Green Road, Crewe, Cheshire.

Mechanical and Model Supplies. The South Eastern Stockists for Myford, E.W. and Adept lathes and accessories. Burnerd chucks. Wolf and Bridges electric drills. Eclipse and M. & W. tools. Picador pulleys, etc.—39, Kings Road, St. Leonards-on-Sea, Sussex. Tel.: Hastings 4993.

Unrivalled in its Class. The E.W. 2½″ × 10″ lathe. Model "A" plain lathe £13 4s. 0d. Fully convertible to back gear and screwcutting. Can be obtained from 5s. weekly. High-speed sensitive power bench drilling machine. Chuck capacity ⅜″, £6 10s. 0d. Terms from 2s. 6d. weekly. Adept lathes, shapers, Perfecto shapers. No interest, no fuss credit terms. Details s.a.e.—Wanstead Supply Co., 48, High Street, London, E.11.

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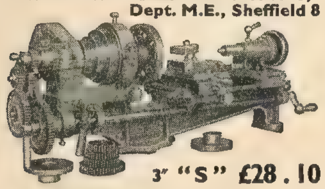

3″ "S" £28 . 10

Milbro Equipments for tool bargains, full lists 6d.—81, Derby Road, Nottingham.

We are Extending our offer to include free of charge, four extra tools to customers purchasing a set of our tipped lathe tools price £2 10s. 0d. set to December 30th.—Corbett's (Lathes), Stanton Hill, Sutton-in-Ashfield. Amateur Lathe Book, new edition 15s.

Myford M.L.7 Lathe motorised, fitted clutch, 4-jaw chuck, indistinguishable from new, only few months old, £60 o.n.o.—Fisher, 96, Bentley Street, Lockwood, Huddersfield.

Milling Machine 15″ × 4½″ table, ½ h.p. S.P., B.T.H. motor nearly new. Drive through 3-speed gearbox. Vice, accessories and good selection cutters, all in perfect condition, £35 the lot. Phone Streatham 0280 after 7 o'clock, ask for Mr. Holder.

Geo. Adams 2½″ Precision Lathe complete with standard equipment for sale, £20. S.A.E.—Box No. 7550, Model Engineer Offices.

Illness. For Sale 4½″ Winfield Lathe, screwcutting with chucks, swivelling vertical-slide and machine vice ½ h.p. Hoover motor 230/1/50. Separate motorised countershaft Hoover 1/3 motor. Double ended 6″ Wolf electric grinder. One ⅜″ motorised sensitive bench drill. One bench power hack-saw. One twist drill grinder. Inumerable taps, dies, twist drills. Steel and brass stock. Particulars from—Fozard, 61, Meldrum Street, Oldham, Lancs.

For Sale. Alba 1A power shaper, 10″ stroke with motor, perfect condition, £50.—Spear, 2, Thorncroft Road, Sutton, Surrey. Vigilant 8435.

Pool Bench Milling Machine, countershaft, cutting arbor, £30. As new.—F. Sweet, 40, Kingsley Street, Battersea.

Pedestal Horizontal Mill, 18 × 6 table, rack feed, £15. Similar screw feed, £10. Sjorgen collett chuck, £8. Wanted. Southbend lathe or spares, equipment. Small vertical mill any condition.—Brown, 73, Browns Lane, Allesley, Coventry.

Zyto 12 Lathe. Two treadle stands (one round belt) stand equipment, plus 4″ s.c. chuck, 4″ ind. chuck, ⅜″ and ½″ drill chucks, tailstock dieholder taps dies, combination set, etc., £40.—Watts, 38, Tivoli Crescent, Brighton, Sussex.

Wood Turning Lathe, 36″ overall, 20″ centres, fitted 6″ saw table, quality machine, in new condition, complete and with 4 saws, £11. Slide rest, suitable 4″ or 5″ lathe, £3. Burnerd 3″ lever scroll, s/c chuck with spare jaws, 45s.—W. Moldon, 35, Ealing Village, London, W.5.

4½″ × 18″ S.C., B.G. Winfield Lathe for sale. Centres, change wheels, 4-jaw chuck, faceplate, D/plate, countershaft and accessories, £22. Call Saturdays.—Mr. R. Chettleburgh, 4, Elmcroft Street, Clapton, London, E.5.

Myford-Drummond 3½″ Lathe. Standard equipment, motorised, stand, three chucks, vertical-slide, many accessories. Nearly new condition, £75 o.n.o.—Brown, 36, Godalming Avenue, Wallington. CROydon 9501.

Sale. Back Gear for 4″ Drummond. Incomplete lathe. Damaged drilling machine. Belt bench grinder. Coarse gears at scrap prices.—Pike, 36, Brenthouse Road, Hackney.

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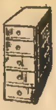
Zyto 12″ Lathe with 3″ chuck, faceplate, changewheels, etc., £18. Power bench drill, belt drive, £2. Portable treadle wheel, 15s. 24 volt, d.c. series motors ¼″ shaft, 10s. B.T.H., 3CV. FT Refrigerator cabinet, internal light, £2.—Charles Ronald Starnes, 104, Wilberforce Road, London, N.4.

Surface Plate 12″ × 8″. New, C.I., 50s. Milling cutters, new, 90 mm. dia. S. & F. H.S.S., 30s.—Hall, 138, Gathurst Lane, Gathurst, Nr. Wigan.

Myford M.L.7 Startrite ⅜″ drilling machine, Myford accessories and small tools. Can be seen at—147, London Road, Stockton Heath, Warrington. Buyer collects.

If not satisfied return within 14 days Cash refunded in full.

Five drawer Steel Tool Cabinet. Drawer sizes are 7" × 3¼" × 1 7/16". 11s. 6d.



Five drawer Wood Tool Cabinet. Drawer sizes are 6" × 4" × 1 3/16" steel. 12s. 6d.

Or for 6s. extra Bolts, Nuts, Springs, etc., etc., about £1 worth will be sent with any tool cabinet.

Six drawer Steel Tool Cabinet, 33" high. Drawer sizes are 9" front, 3¾" high, 18" front to back, £2 7s. 6d.

Bright and Cadmium plated nuts and bolts, 14 lb. 16s.; 28 lb. 30s.

All carr. paid G.B. and N. Ireland, packing free. C.W.O.

18,000 hardened, and ground tool steel drill bushes, 1s. each, 10s. for 12, or £3 10s. per 100. C.W.O. or C.O.D.

E. HUNTINGTON
38a, Cemetery Road, Southport, Lancs.

For Sale. **3½" Willemott Ideal S.C** gap bed. Lathe takes work up to 18 in. long. Complete with oil tray. Combined overhead motor and driving gear, 230 volt, single phase, S.C. chuck, little used. Accept best offer up to £40. —CAMPBELL, "Cloncunny," Faulkners Lane, Mobberley, Cheshire.

Wanted, Ornamental Lathe and accessories. Complete workshop considered. State details, price.—Box No. 7557, MODEL ENGINEER Offices.

Sale Owing to Removal Portass Dreadnought 3⅝" centre lathe, 4-way toolpost, chucks, tools, on stand with motor, £75. Milling machine on stand, motor, etc., £40. Drummond 7" hand shaper, £25. 3½" gauge locomotive and tender, £125.—POTTER, 66, Newlands Park Crescent, Scarborough.

Shaper, "Adept," 3½" stroke, as new £4 15s. 0d.—BALDWIN, Culverden Down, Tunbridge Wells.

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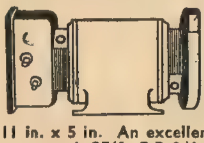

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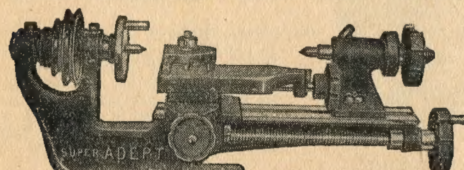

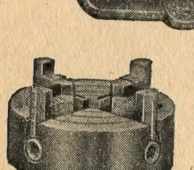

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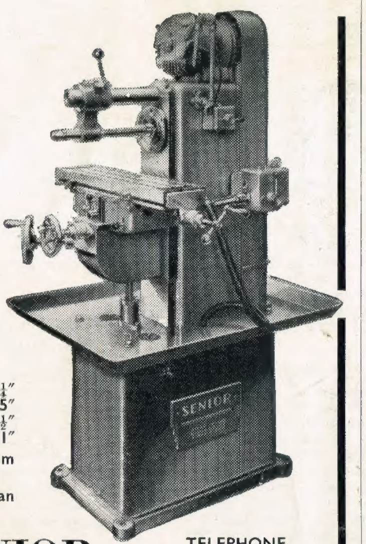

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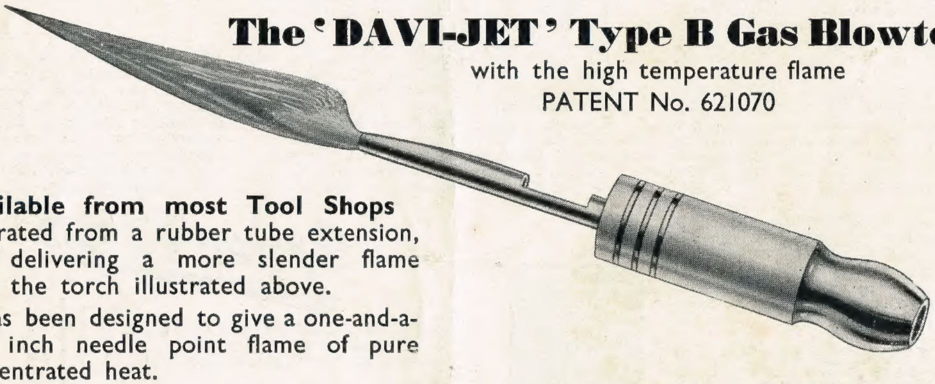

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